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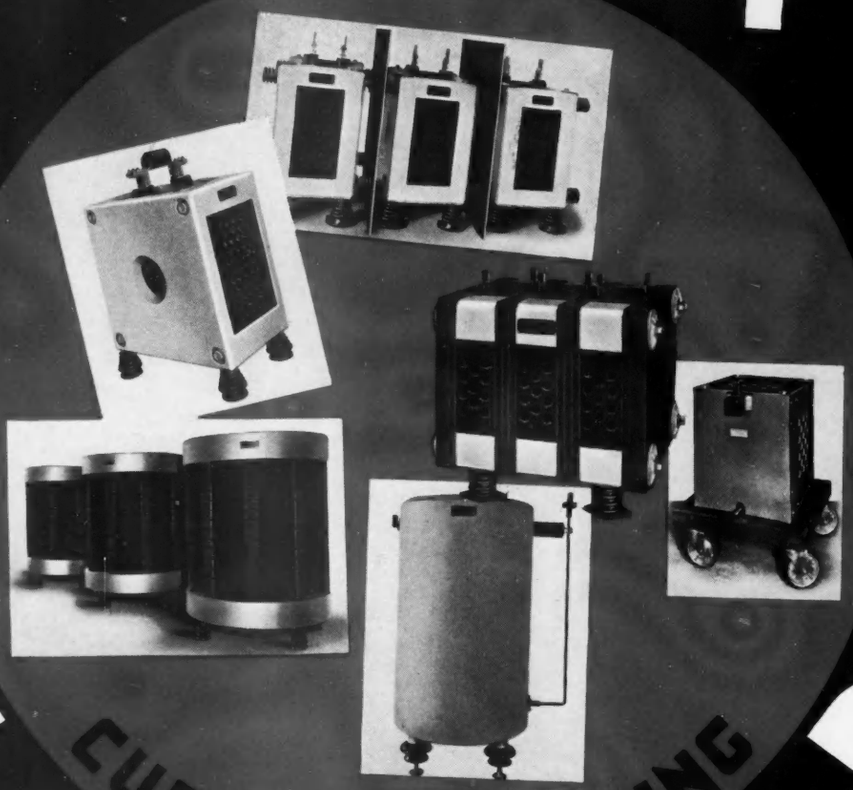

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October 4, 1941

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McGRAW-HILL PUBLISHING COMPANY, INC.
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Electrical World—Published weekly. Price 25 cents a copy. Allow at least ten days for change of address. All communications about subscriptions should be addressed to the Director of Circulation, 330 West 42d Street, New York, N. Y. Subscription rates: In the United States, Mexico, Central and South American countries, $5 a year, $8 for two years, $10 for three years; Canada, $5.50 for one year, $9 for two years, $11 for three years (Canadian money at par). Great Britain and British possessions, 54 shillings for one year, 108 shillings for three years. All other countries $9 for one year, $18 for three years. Entered as second-class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A. Contents copyrighted, 1941, by McGraw-Hill Publishing Company, Inc. Branch Offices: 520 North Michigan Avenue, Chicago; 68 Post Street, San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington, Philadelphia, Cleveland, Detroit, St. Louis, Boston, Atlanta, Ga.

Publication Office
99-129 North Broadway, Albany, N. Y.

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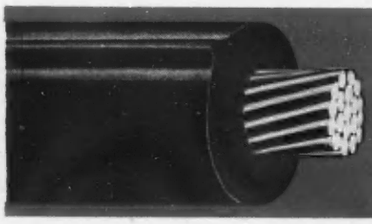

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INSULATED WIRES AND CABLES

Low-Cost Reliability Obtained in Plant Expansion

Mixed-pressure turbine and stoker-fired, integral-furnace boiler provide low-cost extension for isolated Iowa City plant with no sacrifice to reliability — Load characteristics dictate stoker in preference to pulverized fuel

E. H. THROCKMORTON, United Light & Power Service Company, Davenport, Iowa*

ANALYSIS of load in the Iowa City area, served exclusively from the Coralville plant of the Iowa City Light & Power Company, showed conclusively as early as 1938 that additional boiler and turbine capacity was needed to supplement the plant's existing 150-lb. generating equipment, consisting of a 1,000- and a 3,000-kw. turbine.

The resulting addition, built during 1940 at a cost of $90 per kilowatt, consisted of a 5,000-kw. mixed-pressure turbine and boiler with a capacity of 60,000 lb. per hour at 400 lb., 740 deg., together with necessary building extensions. Annual design load factor was 45 percent, design heat rate 14,440 B.t.u. per kilowatt-hour. Initial operation is with 1,040 B.t.u. gas costing 16.5 cents per 1,000 cu.ft. Stoker-fired Illinois coal costing approximately $3 a ton is standby fuel.

Several interrelated factors influenced the design of the addition to this 25-year-old station. Pressure adopted was largely determined by the fact that when the last (3,000-kw.) turbine was installed in 1930 it was arranged for initial operation on 150 lb. steam and subsequent change to 400 lb. Because the plant was small and located near coal fields and gas lines insuring low fuel cost, more efficient, yet more costly, high-pressure equipment was uneconomical. However, since this was an isolated plant, serving Iowa City alone, a high degree of reliability was essential. Thus, with operating pressure determined in advance, the problem resolved itself into securing additional capacity at the lowest first cost consistent with reliability requirements of an isolated plant.

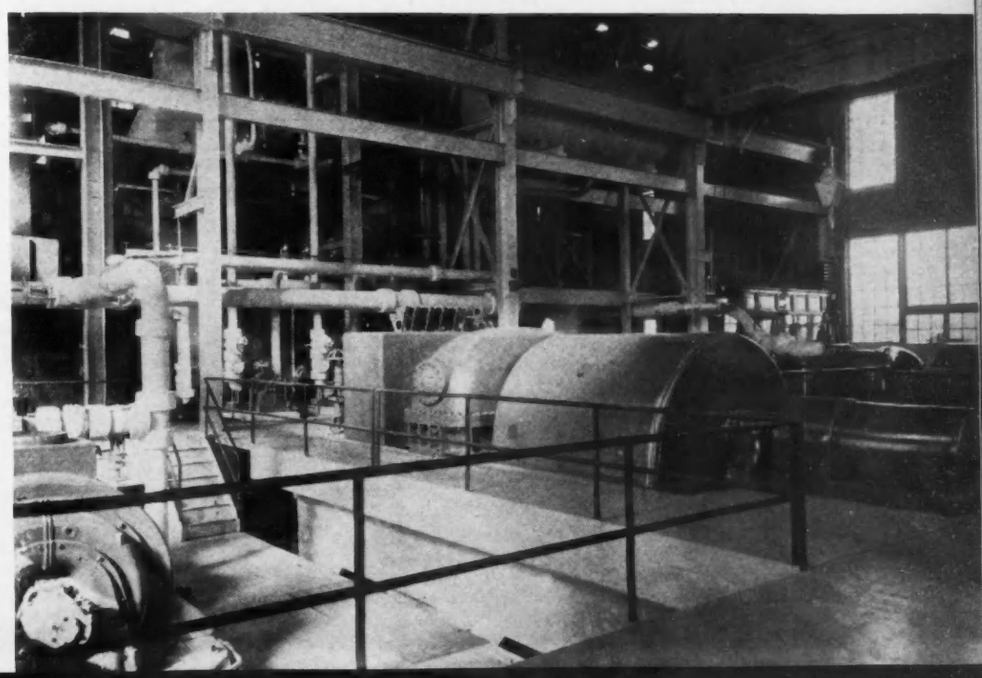
Features of the extension which contributed to this objective were, briefly: (1) Selection of a turbine which could be operated at both 400 and 150 lb. avoided investment in a second 450-lb. boiler by making use of existing 165-lb. boiler as standby. (2) Use of the integral-furnace boiler reduced the height and cost of the boiler room extension compared to that for a bent-tube Stirling-type unit. (3) Use of a spreader-type stoker instead of a more extensive powdered coal system, less adaptable to long light load periods characterizing the Iowa City load curve, contributed to reliability. (4) Compact building arrangement and elimination of curtain walls further reduced investment and permitted use of a three-man operating crew. (5) Availability of the boiler plant was improved by bringing both 150- and 400-lb. steam lines into the main 400-lb. header and providing an automatic valve arrangement to bring 150-lb. boilers in automatically on failure of 400-lb. supply.

New Turbine

Turbine selected for Iowa City was a 5,000-kw. condensing unit operating at 3,600 r.p.m. on steam at 400 lb., 740 deg., and against an absolute back pressure of 1 in. Hg.

Early analysis revealed that to avoid expense for a second 450-lb. boiler and to make effective use of existing 165-lb. boilers as standby

ABSENCE of curtain walls, compact building construction and use of low integral furnace boiler cut building cost. As seen from the switch bay is the 5,000-kw. turbine and boiler, the surge tank and 1,000-kw. turbine



*Mechanical engineer.

the new turbine should be designed to deliver 5,000 kw. using 150-lb. steam.

This desired performance was secured by using a slightly oversize 400-lb. turbine design with eight control valves instead of six. Six valves would pass sufficient 400-lb. steam to deliver 6,250 kw.; with eight valves, the turbine will deliver 5,000 kw. using 150-lb. steam.

With a 5,000-kw., 400-lb. turbine operating on 150-lb. steam the water rate was found to be 1½ percent lower for light load and 5.6 percent higher for full load than for a machine designed for 150 lb. However, water rate of the special 400/150-lb. machine operating on 400-lb. steam was 0.3 percent higher on light load and 0.2 percent lower at full load than for a straight 400-lb. machine. A fulcrum-shifting device on the governor prevents opening the seventh and eighth valves and overloading the generator when operating on 400-lb. steam.

When the extension was made the 3,000-kw. turbine, which had operated since 1930 on 150-lb. steam, was rebladed for operation on both 400-lb. steam and 150-lb. As rebuilt it is rated 3,750 kva. on 400-lb., 3,000 kw. on 150-lb. steam.

Main Steam Header

Arrangement of the 150- and 400-lb. main steam lines is such that either boiler will supply steam to the main 400-lb. header automatically if the other steam supply is interrupted. To accomplish this an automatic 400-lb. standard non-return valve was provided in the 150-lb. steam line near the steam header, with safety valve between the 400-lb. non-return valve and the 150-lb. boiler non-return valve.

With this arrangement, for example, if the 400-lb. boiler is "lost" and pressure in the header drops below 150 lb. standby boilers start to deliver steam to the header through the non-return valves in the 150-lb. line. Low-pressure steam cannot enter the 400-lb. boiler against the non-return valve in that line. As the 400-lb. boiler comes on again and pressure in the header builds up, steam is prevented from entering the 150-lb. boiler by non-return valves in the 150-lb. line, which are set against 400-lb. pressure. Should the valve nearest the header fail the safety valves and second non-return valve protect both the line and the 150-lb. boiler.

The boiler at Iowa City is a modification of the B & W type F integral furnace boiler for use with a spreader stoker. Its capacity is 60,000 lb. per hour at 400 lb. pressure, 740 deg. temperature at the superheater outlet. At present it is operated on 1,040 B.t.u. gas purchased under a favorable dump contract which is interruptible on three hours notice. Southern Illinois Coal is used as standby fuel. This arrangement, however, is expected to be reversed in the future, using coal as base fuel and gas as standby.

Modification of the integral-furnace boiler consisted of adding an idle gas pass at the rear of the furnace, which is 15 ft. 3 in. wide and 12 ft. 6 in. deep at the grate line and completely water-cooled. Full stud-tube construction is used in front and roof, partial stud-tube construction for the rear wall. The 3¼-in. tubes on side walls are bare.

Favorable experience with four previous spreader stoker installations influenced the selection of similar equipment for Iowa City after careful consideration of pulverized coal equipment. The following reasons may be given for the choice:

1. More flexible fuel-burning range—0-60 lb. per sq.ft. grate area.
2. Substantially less expensive.
3. Capable of burning a smaller size slack coal now available at a lower price than the 1¼-in. screening.
4. Low maintenance cost.
5. Rapid response to change in load.
6. Demand for stoker ash.
7. Good combustion of fuel.

Important in the selection of the stoker over pulverized fuel was more reliable operation of the stoker during extended light load periods; during 1938, for example, there were 2,300 hours when load was less than 1,000 kw.

The stoker has its 187.5-ft. grate area broken into four sections. Each has independent fuel supply, air supply and power-operated ash removal equipment and can be sectionalized when necessary for repair, load control or dumping of ash. The air-cooled grate makes it possible to burn a cheaper coal (10,000 to 10,600 B.t.u.) than can be burned on a chain grate or underfeed stoker. This grate has a cast-iron slab molded around tubes or cooling bins through which air for combustion passes to five tuyeres in the top of the grate slab. These tuyeres are larger at the bottom than on top and will not plug.

Experience with previous spreader stoker installations indicated that it was necessary to have the control for the fuel and air for combustion synchronized or tied together mechanically in order to provide satisfactory combustion. A Cash system of combustion control was selected.

Boiler Test Data—Coal Firing
24-Hour Run, March 15, 1941

Average steam output per hour, lb	20,250
Average steam pressure, lb	418
Average steam temperature, deg	625
Average feedwater temperature, deg	215
Average stack temperature, deg	275
Average CO_2, percent	13
Average lb. coal per hour	2,452
Lb. steam per lb. of coal	8.26
Heating value of coal as fired B.t.u.	11,225
B.t.u. added per lb. steam by economizer, boiler and superheater	1,135
Boiler efficiency	

$$100 \times \frac{8.26 \times 1{,}135}{11{,}225} = 83.5\%$$

Physical Layout

Boiler and turbine equipment was laid out for operation with a minimum operating crew of three men. The boiler firing aisle is adjacent to the turbine room without an intervening wall, so that the boiler and turbine operator can assist each other when there are operating difficulties in boiler or turbine room. The third can assist in both the boiler and turbine room.

The flow diagram for the Iowa City plant extension (on page 50) shows several of the plant's features.

Particular attention is called to the batch-treating tank for make-up water. Experience has shown the batch-treating method to be entirely reliable and the initial investment is much less than for conventional hot process treating equipment. It is accurate and easy to operate because water is measured and chemicals weighed for each batch of water treated.

Complete deaeration of make-up water was necessary and this was accomplished by returning it to the condenser. Further to protect against entrained gas a vented surge tank is used.

From the condenser feedwater is pumped through two closed heaters to a high-temperature surge tank. This tank is provided with a steam injector which increases water temperature during periods when bleeder pressure from the turbine is too low to maintain 220 deg. in the second stage heater.

"Thumbs Up"—Electric Utilities in War-Time England

Women replacing men in many jobs — Men held in key operating positions — Quick restoration makes electricity the preferred service — Domestic consumption rises with employment and wages

MUCH INFORMATION on the effect of war on English utilities has reached this country through the efforts of Davis M. DeBard, vice-president Stone & Webster Service Corporation. Mr. DeBard maintains a voluminous correspondence with friends in England and he makes their letters quite generally available to our electrical industry by circulation of mimeographed copies. Some time ago ELECTRICAL WORLD suggested to Mr. DeBard a number of questions, the answers to which would particularly interest readers of the magazine and would, it was felt, run into no censorship difficulties.

Replies to Questions

Here are comprehensive excerpts from two replies. One answers the questions categorically and is from Harry Towers, general manager of the Edmundson's Electricity Corporation, a company serving some 400,000 customers in various towns in the southern part of England and around London. The other letter, a general reply, is from J. I. Bernard, commercial director of the British Electrical Development Association of England, which corresponds to the Edison Electric Institute in this country.

The questions and Mr. Towers' replies:

1 Q. How extensively are women being used by electric utilities in work formerly done by men? (a) What kinds of jobs? (b) What problems involved? (c) How well is work done in comparison with men?

A. On the practical side of electric utilities in this country women have not been engaged to any extent so far. There are, however, a number of undertakings using women as meter readers and we understand they are doing this work satisfactorily. In one power station, however, women have been engaged on plant repairs and maintenance, cleaning, etc. They are at the moment dealing with lathe work; valve overhaul, grinding in, jointing and packing; drilling machine work, doing own marking off, etc.; overhauling small switchgear components, fitting, filling up and adjusting contacts, switch blades, etc.; looking after tool stores; acting as fitter's mates on general work in the boiler houses and turbine rooms; general fetching and carrying and driving works cars and lorries. It is considered that in the near future probably another dozen women will be employed on repairs and maintenance work, on such jobs as boiler cap cleaning and upon chain grate assembly work. It is further envisaged to use women on such work as the driving of small trucks and for stores and laboratory work. Other stations are following suit.

2 Q. Are utility employees exempted from air warden or home guard or auxiliary fireman duties? Under what conditions?

A. Utility employees are not exempt from air raid warden, home guard, nursing, auxiliary fire and fire-watching services as they are all voluntary. In fact, almost without exception all fit employees are members of one or other of the civil defense services and do a spell of duty in addition to their normal everyday work. No pay is received, though those on fire watching generally get a grant of a few shillings per night with which to buy supper and breakfast.

Most utility companies have a very strong home guard unit of their own which is responsible for the protection of the company's equipment. Members of the home guard are not expected to take on voluntary air raid warden or fire-watching duties, as in the event of an emergency they would be required for whole-time home guard duties.

3 Q. To what extent have non-technical employees been trained to do emergency work?

A. Very little training of non-technical employees has been done to equip these people for emergency work, for the reason that practically every individual has been trained for some voluntary work in the civil defense services. Furthermore, in accordance with a schedule of reserved occupations, technical employees of utilities are, in certain cases, exempt from military service in certain age groups, thus retaining them for essential services.

4 Q. What electrical operating problems are involved in blackouts?

A. In most power stations blackout regulations, coupled with the desire to prevent flying glass due to blast, meant that most windows have been bricked up for the war period and roof window lights screened by wooden structures.

Such places as power stations and attended substations have, in addition to ordinary lighting, a system of what may be termed "pilot" lighting of low intensity located at important points, such as switchboard instruments, turbine controls, etc. Thus, should part of the outside wall of the building be damaged by enemy action and lights exposed, the main lights could be switched off and the pilot lights brought into action, with the result that the operators may continue with their work and no confusion is caused by the building being suddenly plunged into darkness.

5 Q. Are portable generating stations or substations being used to any extent for emergency service?

A. No great use has been made of

portable generating and substation equipment, although adequate stocks of spare transformers, switchgear, etc., are always available to replace equipment which may be damaged. The effects of damage, though in some cases serious, has not been such as could be overcome by the use of mobile equipment.

6 *Q. What new devices have been developed? (a) For use by utilities on their systems? (b) For use by consumers?*

A. Very few new devices have been developed for use by utilities on their systems as a direct result of the war.

(a) So far as devices developed for use by industrial consumers are concerned there are obviously a number which have come into being, but are of such a secret nature that we are not familiar with them. The only new development of importance for use by utilities in their systems has been high-voltage air-blast switchgear. The reasons for this development are:

1. Considerable economy in valuable material.

2. Reduction in fire risk owing to the absence of oil. The general opinion in this country is that this gear has considerable advantages over oil switchgear. We ourselves are installing a large site outdoors with air-blast breakers, 66 kv. and 1,500,000 kva. rupture capacity. Up to date this gear has been developed for 11 kv., 33 kv. and steps are being taken to develop it for 132 kv.

(b) So far as devices for use on consumers' premises are concerned, a number of appliances have been developed to meet the requirements of people who normally use gas for cooking and heating and are unable to do so because of failure of supply. It has been the general experience that where a town has suffered from enemy action the electricity services have stood up much better than gas, in that the former were in a position to make temporary repairs much more expeditiously and thereby maintain an almost uninterrupted supply. Most of these appliances are inexpensive and of such type that we would not recommend them for permanent use. They consist mostly of combination boiling plates and fires.

7 *Q. Have any restrictions been put on the use of electricity or any removed?*

A. No to both. During the first winter of the war a method of rationing electricity and gas was evolved, but was not put in operation as the consensus was that it would be so cumbersome as to be almost impracticable, and no means has yet been devised of cutting off, say, the domestic supplies between certain hours without interfering with the loads for war factories and essential and semi-essential work. At the moment there is absolute freedom to use as much electricity as is desired both industrially and domestically.

8 *Q. What changes has the war brought with respect to (a) Record keeping? (b) Frequency of billing? (c) Rates? (d) Inspection? (e) Overhaul? (f) Regulation?*

A. (a) All essential and important documents have been duplicated and photographed and sent to safe places for storage. Records are located at different points throughout the country to keep them as widespread as possible.

(b) No change has been made in billing periods; most are quarterly.

(c) Generally, increases in rates have been made in 198 local municipal authorities, which is about 53 percent, and in 59 private companies, which is approximately 27 percent, so that out of the total electricity undertakings 43 percent have increased tariffs since the outbreak of the war in September, 1939. The different companies making up Edmundson group have not increased tariffs at all.

(d) Routine inspection and overhaul are carried out, as far as possible, in accordance with peacetime practice, but due to the war we have stopped routine overhaul of meters, except in some of our areas where there are meters of a bad type. Generally speaking, however, the strain put on all plant and equipment working at war pressure is such that a proportionate amount of time has to be put in on inspection.

(e) The opportunities for overhaul, especially of boiler plant, have been reduced, and for that reason considerable attention is being given to the question of boiler availability, which, until very recently, has not compared favorably with American results, and for this reason many of the new plants that are being installed are pulverized fuel fired, the unit system with ample mill capacity being employed in every case.

(f) We have the same government regulations as pre-war, plus goodness knows how many others, dealing with this, that and the other requirement of government departments. It is fair to say that considerably more time has now to be devoted to making returns, filling in forms and generally providing information of use to government and service departments purely for purposes of conducting the war. Many people in this country, of course, think we have far too much regulation and much of the "paper war" could be cut off.

9 *Q. Are increased taxes absorbed by power companies or passed on? If the latter, how?*

A. This varies in different undertakings. Taxes as such have not been considered separately, but increased costs as a whole have been passed on in the way of increased tariffs, unless the undertaking was in such a position that it could absorb them due to increased revenue from general development of business caused by increased industrial and/or domestic load due to evacuation. There was a statement by the Chancellor of the Exchequer some months ago that he proposed to "peg" the price of electricity to prevent further increases in the cost of living. Though the statement was made it has not been followed up by any action, due, one supposes, to the inherent difficulties of "pegging" all other items which go to make up the cost of electricity.

10 *Q. Have there been many cases of sabotage?*

A. We have had no cases of sabotage anywhere in our group and so far as we can ascertain from inquiry elsewhere there have been no cases of real or suspected sabotage in connection with the supply industry.

Another View

Mr. Bernard's letter, although not categorically responsive to the questions, corroborates the replies of Mr. Tower and adds its share of information:

The effect of the blackout at the beginning of the war was to lop off all late afternoon peaks, the load at this time of the day generally falling to something appreciably less than the mid-day value.

Some utilities with large shop lighting loads thus experienced an appreciable increase in load factor. In other areas, where the industrial power load predominates, the afternoon portion of the daily load curve became similar in shape to the morning portion, both depending on the working hours of the factories. Utilities having fairly well-developed domestic heating and cooking load found this load overlapped the morning power load, with the result that peaks were formed at 8 to 9 a.m. and 12 noon, the former being generally in excess of the latter. The breakfast time peak has been particularly heavy during the very cold weather that we have had in both the winters of the war, because central heating is installed in very few English houses and people switch on their electric fires first thing in the morning before the coal fire is lighted.

It is on this account that we hope the coming winter will not be very cold because the munitions load tends

[*Continued on page 134*]

"Safety With Light" Campaigns Augment Utility Revenues

Alabama Power describes techniques employed in Gadsden and Bessemer to tie in with the national program offering revenue possibilities to utilities in 900 cities

JOHN C. TYSON, Jr., Alabama Power Company, Birmingham*

"SAFETY WITH LIGHT" is the slogan of the nation-wide program of the United States Junior Chamber of Commerce† to arouse public interest in the tremendous social value of better street and highway lighting. Alabama is fortunate in having local "Jay-cee" organizations in Gadsden and Birmingham and therefore our company was proud to team up with the Jay-cees and with state officials to reduce the toll of fatal night-time accidents on our highways.

Our State Highway Department, although sympathetic toward the great necessity for modern, safety lighting, had postponed installations on the grounds of insufficient funds or that their program called for major highway improvements that would have to be made before safety lighting could be considered.

Fourfold Hazard

The 1938 report of the Alabama Highway Patrol was released about the same time as the "Safety With Light" programs of the United States Junior Chamber of Commerce. The patrol report revealed the fact that 3,413 accidents, or 58.5 percent of the total number, occurred at night, when only 25 percent of the traffic was on the road. Night driving was, therefore, four times as hazardous as driving in the daytime.

Hitting stationary objects was the prevalent cause of highway motor accidents in Alabama. Speeding brought the most deaths and the greatest financial losses. The accidents from both of the causes were greater at night than in the daytime. With less traffic on the road, it was logical to assume that with good visibility the number of accidents could be materially decreased. This had been proved in all of the Eastern states where highway lighting had been installed. These facts were brought to the attention of the Jay-cees when their national progress was announced and their assistance in joining the cause was solicited.

On January 17, 1939, Alabama's Governor, Frank Dixon, appointed Chris J. Sherlock director of the Highway Department. Mr. Sherlock is a "career man" with the department, having started as computer in 1922 under Alabama's first highway engineer, the late well-known W. S. Keller. Mr. Sherlock has served as draftsman, inspector, instrument man, resident engineer, division engineer, assistant engineer and chief engineer. He has always considered the safety of the motorist uppermost in the design and construction of the highways. Under his supervision all of the principal roads in the state will be completed and four-lane approaches provided to the larger cities. Because of his interest in highway safety, Mr. Sherlock was immediately interested in the junior chamber's proposal to make the highways safer with light.

It was proposed that the Alabama Power Company furnish and install

BEFORE this 5-mile Alabama Power system was installed, to stop accidents, the ten-month toll was 71 night traffic accidents, 153 vehicles damaged, 43 injured, seven killed. Company and state officials cooperated in Junior Chamber of Commerce program.

*Director of lighting sales.
†Active membership (150,000) restricted to young men under 36 years of age.

DAYLIGHT VIEW of Gadsden-Attalla highway. Extra length mast arms permit pole setting away from the highway border; 6,000-lumen lamps, on 25-ft. mounting, 125-ft. staggered spacing; note pedestrian on highway instead of on sidewalk

necessary equipment to light several miles of highway for experimental purposes and for the state to pay for current and lamp maintenance under a regular street-lighting schedule. This was agreeable and the site selected for the first installation was the Attalla-Gadsden Highway. This road is not only an important local thoroughfare, but also carries the heavy east-west traffic of U. S. Highway No. 411 between Birmingham and Rome, Ga., and the north-south U. S. Highway No. 241 between Huntsville and Anniston.

The road is a 40-ft. strip of light colored concrete with wide parking areas on either side. The total distance between Attalla and Gadsden is 5 miles. Approximately 1.4 miles of lighted thoroughfares lay within the municipalities, leaving 3.6 miles unlighted. It was proposed to light only a 2.25-mile section as a starter, leaving 1.35 miles of poorly lighted roadway for comparison.

The lighting specifications called for 83 6,000-lumen lamps in pendant type luminaires mounted 25 ft. above the pavement on 125 ft. spacings, staggered arrangement. The wooden poles were set well back from the roadway and lamps suspended 2 ft. inside edge of pavement by means of extra long mast arms. The resultant illumination approximates 0.26 ft.-candles, which is nearly eight times full moonlight intensity, and provides excellent visibility under all conditions as shown in the accompanying illustrations. The installation was made and is maintained by the Alabama Power Company and the state pays for the current consumed and the maintenance involved under a standard street-lighting contract.

The agreement was made and the date of dedication set under the sponsorship of Walter B. Mills, president of Gadsden Junior Chamber of Commerce, who was also state chairman of the Safety with Light Committee.

The State Highway Patrol readily agreed to cooperate in keeping all necessary accident records as a comparative study of accident rates and their causes.

So far as known this was the first modern highway lighting installation in the Southeast and marked Alabama as the location for another pioneering service in the South, which resulted in much saving to the public in human suffering and financial loss.

Public Acceptance

Under the sponsorship of the Gadsden Junior Chamber of Commerce an outstanding celebration was conducted at the dedication of the highway on December 12, 1939. More than 5,000 people turned out for the ceremony and hundreds of others listened on their radios when state, county and local municipal officials "orated" on the turning on of the lights.

The project was so well received that the local Gadsden Jay-cees wished to submit the project for the National Award offered by their national organization at the annual convention which was held in Washington, D. C., in the spring of 1940. From many entries submitted the Attalla-Gadsden project was selected by the judges as one of the two most meritorious safety lighting installations made during the year throughout the United States. The Gadsden and San Francisco Jaycees shared equally in a monetary award and each received a certificate of merit. In addition the Gadsden Jay-cees received a large handsome loving cup for the most successful campaign conducted by any Junior Chamber of Commerce in the United States in towns of less than 100,000 population. The "Safety With Light" program had been conducted by the Jay-cees in 86 cities scattered throughout the nation during that year.

The entry has been reproduced and given wide circulation under the title "Seven Live." Copies of the booklet were mailed to the Governor and highway director of each of the 48 states as well as to the 900 cities throughout the country where local branches of the Junior Chamber of Commerce are established.

The state committee also mailed copies to every county and municipal official in Alabama. The recognition received served to arouse the enthusi-

[*Continued on page 139*]

Priorities Control Methods for Power Utilities

Blanket priority given to maintenance and repair requirements — Emergency repair needs to be handled as separate cases — Major capital additions to get project priorities — Asks sales promotion be halted

*J. A. KRUG, Chief Power Consultant, Office of Production Management**

YOU MEN assembled here have a great responsibility. You operate the power systems of a most important area of defense production. The nation is dependent upon the successful performance of that job. This great responsibility, however, is not yours alone. Power is a public business, and many public agencies share responsibility with you. The various public operating and regulatory agencies —local, state and federal—which are concerned with vital questions of utility policy will certainly realize that expeditious action is required to meet the problems. All of these agencies—state and federal, public and private —must work together during this period of emergency as never before and set aside whatever differences they have. This must come if we are to meet successfully the challenge of today.

In the Public Interest

Since the power business is public business, it is every one's affair and all of the interested agencies and the power systems, private and public, must work together to a common goal. Specifically, they must be in agreement that

1. Adequate power supply is absolutely essential to adequate defense.
2. The power supply we need cannot be obtained without (a) maximum utilization of our existing facilities through power pooling arrangements and interconnecting transmission lines in order to permit the transfer of surpluses, and (b) through the prompt installation of necessary additional capacity at strategic locations.
3. Funds for expansion must be readily available.
4. There must be close cooperation between utilities and regulatory authorities on all matters of plant expansion and the promptest action on matters requiring regulatory commission approval.
5. Defense agencies must assure the power industry of a steady flow of materials and equipment needed to safeguard service and meet expanding defense power requirements.

Several of these points merit detailed consideration, but I shall confine my discussion to what the Office of Production Management is doing about the priority problem. We are fully appreciative of the vital importance to the nation of all utilities. We are working diligently to establish a practical plan of priorities control covering the problems of the utilities. This plan is still in its infancy, and we welcome your advice and counsel concerning improvements.

In working out this plan, we have divided the priority problem into three parts, each requiring special treatment: First, that of obtaining for the utilities the materials, supplies and equipment needed for maintenance and repairs and day-to-day routine operations; second, the question of emergency repairs and special service requirements, and third, the consideration of major expansion projects, including generating stations, substations, transmission lines, and major distribution system improvements. I wish to consider these in order.

You are all now acquainted with Priorities Order P-46, which permits any agency supplying power service directly or indirectly to the public to apply a blanket priority rating of A-10 on all materials, equipment and supplies needed for the routine maintenance, repair and operation of power systems, including such minor additions to capital as the connection of customers to the existing systems and minor improvements necessary to relieve serious overload conditions.

Barest Minimum

You will note that the provisions of this order give utility management a considerable degree of judgment. The intent, however, should be clear. It is essential that you restrict your requirements for strategic materials to the barest minimum which prudent operation will permit. Without quibbling about the literal meaning of the order, you are expected to conserve every possible pound of copper, steel, aluminum, zinc and other short materials. Subject to certain controls, you are permitted to use as much material in dollar volume as you used in 1940. It is our expectation, however, that you will find a way to do better than this.

I will not attempt at this time to define the various provisions of this order other than to say that there will shortly appear an inventory and use of materials form which you will be asked to report on and which will serve at least three functions: First, to acquaint you with what is meant by the limitations of section (f) of the order; second, to provide us with the data to estimate the probable requirements of the industry for stra-

*Excerpt from address to Engineering and Operating Section, Southeastern Electric Exchange, St. Petersburg, Fla., September 26, 1941.

tegic defense materials, and third, to provide a basis for checking the activities of each system.

There will be many questions of definition. We ask that you patiently await official interpretations, which will be released from time to time, and use your best judgment meanwhile. But to the extent that any provisions of the order create problems which must be solved at once, I suggest that you communicate with me by letter, stating as succinctly as possible the nature of your difficulty. This blanket authority to purchase materials under a defense rating will be recalled if the utility systems do not exercise restraint and sound judgment in exercising the privileges given to them under it. A more rigorous method of control must be devised, if the provisions of the new order are abused or circumvented or prove to be ineffective in securing sufficient curtailment. The general purpose of the order is to give you the material and equipment you need to maintain and operate your respective systems, exclusive of the emergency situations and major projects, which should be handled separately, as I will explain.

Emergency Repair

It is clear to us, of course, that the procedure outlined in P-46 cannot hope to meet the emergency situations which will develop from time to time upon your systems. It is our present thought that no formal procedure to accomplish this purpose will be announced, as we feel confident that cases of real emergency will be referred to the Power Branch of OPM by telephone without delay. That conclusion was arrived at after giving due regard to the ingenuity of those responsible for the management of our power systems.

In further respect for this same ingenuity, we do not wish to develop a procedure which will be employed in order to obtain repair materials which should be available under P-46. And the emergency procedure should not be used when you can draw upon your own inventory, which can then be restored under P-46. Should you encounter any serious difficulty which is not covered by P-46, you will not hesitate to call or wire me in Washington to explain the nature of the problem so that we may find a prompt solution. It will be possible to cover all serious emergencies by an informal procedure through which we will clear your orders for repair materials directly with the supplier by telephone. I am sure that the utility systems will not abuse this privilege.

Project Priorities

The procedure which I have outlined should cover all of your requirements except the equipment and materials needed for major capital additions or plant improvements. We are now organized to handle these more important matters as comprehensive projects. Once a project is approved, a priority rating will be assigned to the entire project, which is extensible to suppliers and manufacturers for all items of equipment essential to the completion of a project. The procedure is to address your letter to me in Washington, describing the nature of the project, explaining its need, and listing the delivery dates required for all major items of equipment and material in order to meet the final completion date which is necessary.

We will make available shortly a detailed outline of the data which should be provided in project applications. If you comply with these instructions carefully, no personal trips to Washington will be necessary. In fact, for the most part the best way to secure an adequate and understanding consideration of your projects will be through full and careful presentation in the application, rather than by personal appearance in Washington. The fact is that during recent months most of our staff has been required to spend the daylight hours listening to purchasing agents and company officials on matters of special interest to them, leaving only the evening hours for detailed analysis of the applications which are pending.

I trust you appreciate that it will be impossible to assign high preference ratings to projects unless it is clearly shown that they are necessary for defense or essential civilian activities. Projects justified only by improvement in service, including the maintenance of liberal reserve allowances, cannot be given defense preference ratings. Should we agree with you, however, that a given project is necessary, we will assign a preference designation which should permit delivery of the equipment necessary to complete the project in an orderly schedule to meet the requirements of service. Should the project rating fail to obtain delivery for any specific items of equipment, you must apply for special treatment of such items so that a decision may be reached concerning a new rating or, in the alternative, so that the entire construction schedule may be readjusted to the condition thereby created.

It is expected that no projects will be submitted in those cases where the material and equipment is covered by P-46. And, for the present at least, we trust that your judgment, guided by the provisions of P-46, will bring to us separately only those matters which deserve special attention.

Effect of Allocations

The three separate procedures that I have just outlined are designed to meet the priorities problem of the power systems. A word of explanation concerning the relationship between this priorities system and the allocation methods used for certain materials may be in order. The assignment of the preference rating in the method described should insure your ability to secure most of what you need. Certain critical materials, however, are more difficult to secure. Because of serious shortages, such materials, including aluminum and copper, have been placed under 100 percent allocation control by the Director of Priorities. This means that no delivery of such materials may be made without the specific approval of the Director of Priorities. Since the supply of these products is not adequate to take care of all needs and, in some cases, is even inadequate to fill all vital defense and civilian needs, it is obvious that some orders will have to be cut down and some delayed or not taken care of at all, even when they bear preference ratings.

Generally speaking, the preference system is being used as a guide to allocation in these areas, so that most orders that bear preference ratings will be taken care of. But it is important to remember that the mere assignment of a rating is not a guarantee that the person using it will be able to obtain the scarce materials. Where it is impossible to obtain them under the assigned preference through the ordinary supply channels, application should be made through my office or directly to the appropriate Commodities Section to insure that

[*Continued on page* 120]

Standardizing Substation Designs

Setting up preferred practice in layouts simplifies the use of material and equipment while retaining flexibility in satisfying local conditions

BASIL PAYNE, Engineering Department, Nepsco Services, Inc., Augusta, Me.

THE ECONOMIC VALUE of standardization and quantity production so well exemplified in commerce and industry today underlies other fields also, appearing even in such undertakings as substation design. Broadly speaking, standardization in larger areas involving the assembly of unit parts into different types is achieved by breaking down the finished product into smaller units which may be assembled in combinations as desired, much on the order of toy building blocks. While the application of standards has probably reached its highest development in manufacturing plants, there is no reason why the same principles may not be applied profitably to substation layouts.

A word of caution should be noted in passing. To be of real value standards must always be the means to an end and never permitted to become the end itself. In certain extreme cases standards which are entirely acceptable in themselves have been applied so rigidly and arbitrarily as to become a bar to further progress. Under more ideal conditions, at least as applied to substation work, standards should be considered as guides to be followed in general, but not so rigidly enforced as to prohibit making a change or variation when such a course is advantageous. In order to avoid the suggestion of inflexibility sometimes associated with the term "standard," other terms, *e.g.*, "preferred practice," are in use. The term "standard" has been retained in this article, but it is to be interpreted in its more liberal sense.

In originating a system of standards as applied to substation structures the mistake is sometimes made of first designing an arbitrary standard and then attempting to adjust the individual application to this. Under such a program the results often are not entirely satisfactory, and in consequence the idea of standards may be dismissed as unworkable. A more logical procedure is that in which the standard design and layout are worked up on the basis of the requirements of one or more actual representative jobs, keeping in view the possible application to other similar work.

This method is illustrated in connection with the production of a standard substation layout designed to satisfy a certain set of conditions. The problem in this case was to provide a small steel frame substation

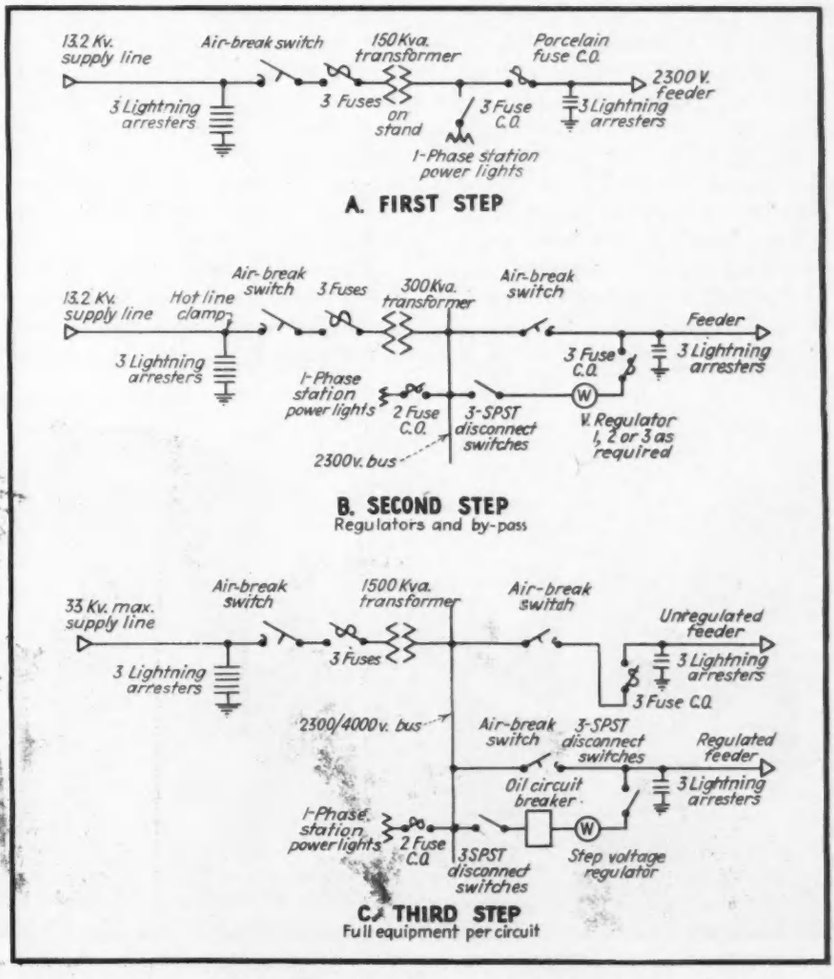


FIG. 1—One-line wiring diagrams showing three steps in layout to meet increased requirements

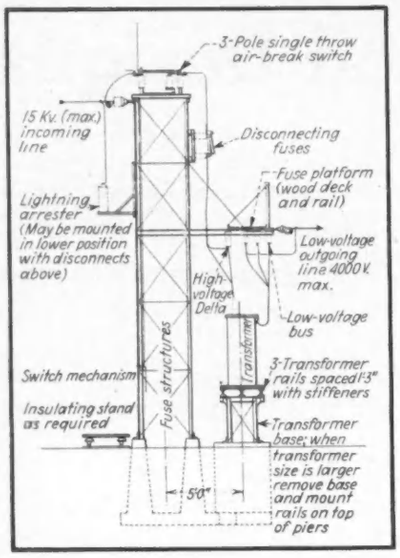

3-Pole single throw air-break switch
15 Kv. (max.) incoming line
Disconnecting fuses
Fuse platform (wood deck and rail)
Lightning arrester (May be mounted in lower position with disconnects above)
Low-voltage outgoing line 4000 V. max.
High-voltage Delta
Low-voltage bus
Transformer
Fuse structures
Switch mechanism
3-Transformer rails spaced 13" with stiffeners
Insulating stand as required
Transformer base; when transformer size is larger remove base and mount rails on top of piers
5'0"

FIG. 2—Structural layout for Step (a), Fig. 1

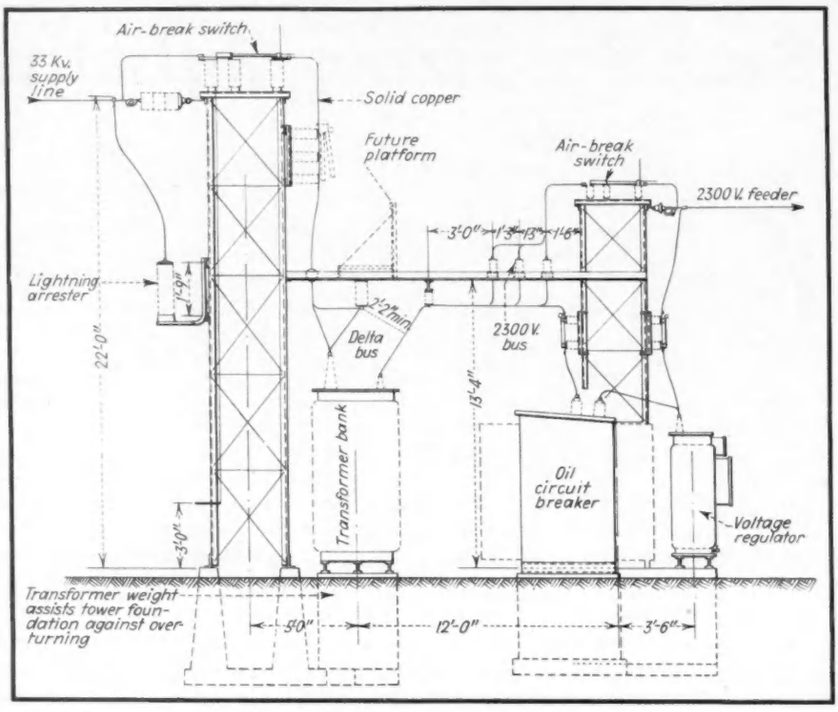


FIG. 6—Structural layout of substation of Fig. 1 (c)

structure which would satisfy the needs of a group of old wood-pole substations requiring replacement, and which would also be suitable for new substations for a similar class of service. These substations had many points in common and lent themselves very nicely to standardization.

The standard layout was designed to cover a supply voltage of 34.5 kv. minimum; a service voltage normally 2,300/4,000, 13.2 kv. maximum, and a capacity range of approximately 150 kva. to 1,500 kva.

Equipment on the high side includes an air-break switch on the incoming line, a lightning arrester with hot line clamps or disconnecting switches and fuses with access platform for renewals. On the low side the layout provides, per circuit, air-break switching facilities, oil circuit breaker, outdoor or metal clad (or fuse cutouts). One, two or three voltage regulators are provided as required, and there are disconnecting switches for isolating the breaker and regulators.

These equipment items represent the maximum for which provision is made. Any desired arrangement using fewer parts is possible by omitting unrequired items, but any or all omitted items may be added at any time as desired. With the flexibility of arrangement thus available, this standard substation in its various assemblies is capable of satisfying a wide range of requirements and at the same time to provide for future extension to meet the demands of load growth.

The structural layout corresponding to the simplest and most elemental one-line diagram for a substation is

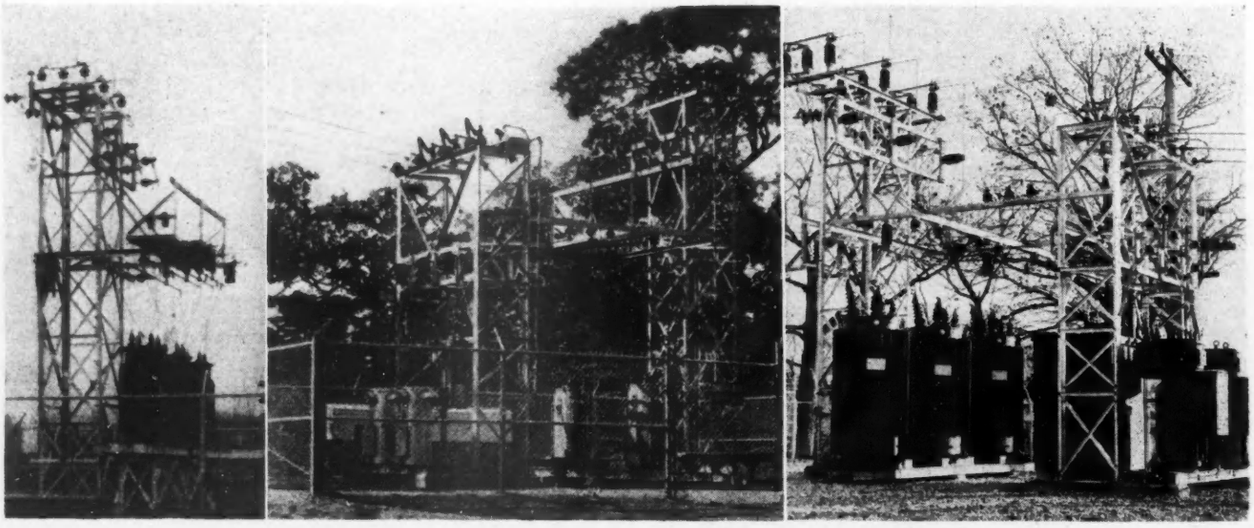


FIG. 3 (Left)—Perspective view of substation of Fig. 2. Station service transformer on tower opposite fuse platform; sheet metal housing for secondary fuses, light switch and outlet below. Fig. 4 (Center)—Perspective view of substation of Fig. 1 (b). Fig. 5 (Right)—Perspective view of substation of Fig. 1 (c)

shown for typical design. With larger transformers the stand would be omitted, mounting the units on rails carried on concrete piers. This procedure is also applicable to designs where an existing transformer bank becomes outgrown. Where feeder regulation is desired the installation may take on a somewhat more comprehensive form, and the additional parts required may readily be provided, or, if desirable, the entire layout may be installed at one time for a new substation. With such an installation the transformer bank may be of any desired capacity, and one, two or three voltage regulators per feeder may be provided. The number of feeders may be increased as neces-

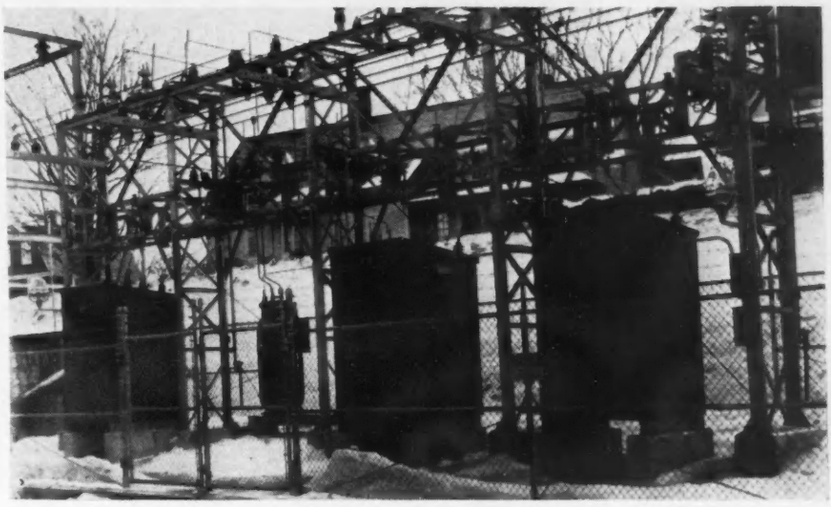


FIG. 7—Perspective view of three-bay substation

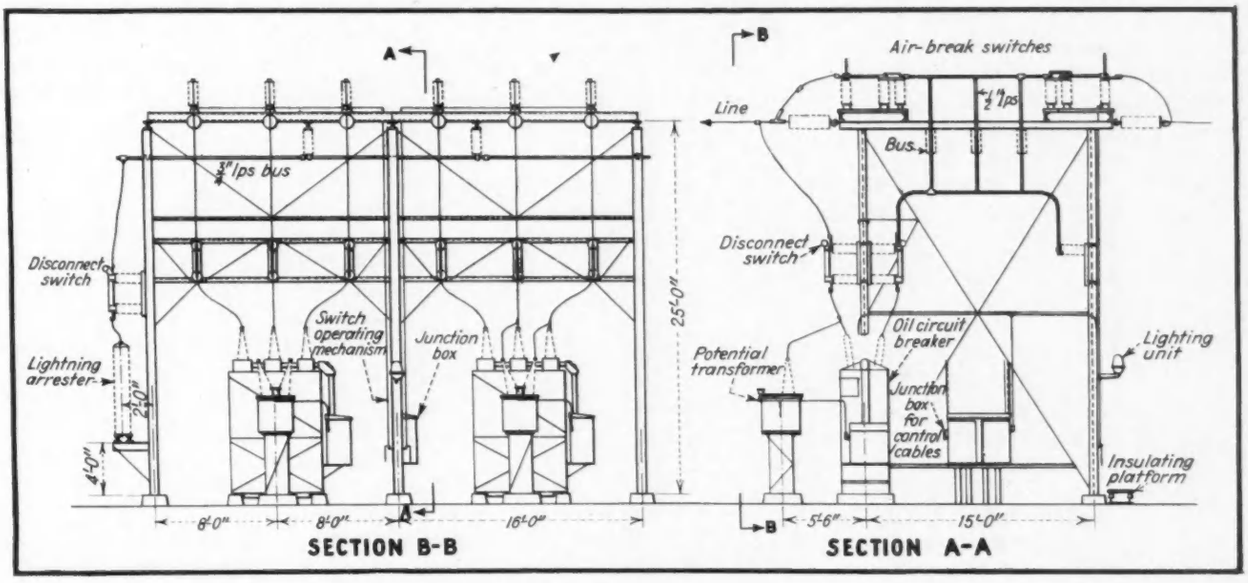


FIG. 8—Elevations of layout for 11-kv. and 33-kv. substations

sary by adding low-voltage bays and the required associated equipment.

Total weight of steel for a single bay substation of the type shown (Figs. 1b, 4 or 5) is about 5,630 lb., provided as follows: High-voltage structure, 2,050; low-voltage structure, 2,300; transformer foundation rails, 830; regulator foundation rails, 325; oil circuit breaker house rails, 125 lb. These weights include assembly and anchor bolts.

Maximum equipment per circuit for which this series of substations was designed is shown in the diagram (Fig. 1c). The four-bay structure shown (Fig. 7) accommodates one unregulated power feeder, regulators and two regulated lighting feeders.

[*Continued on page 136*]

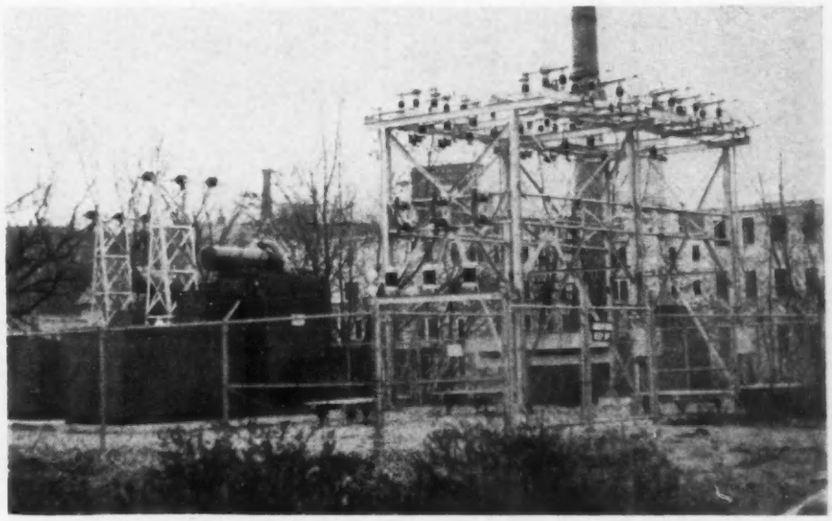
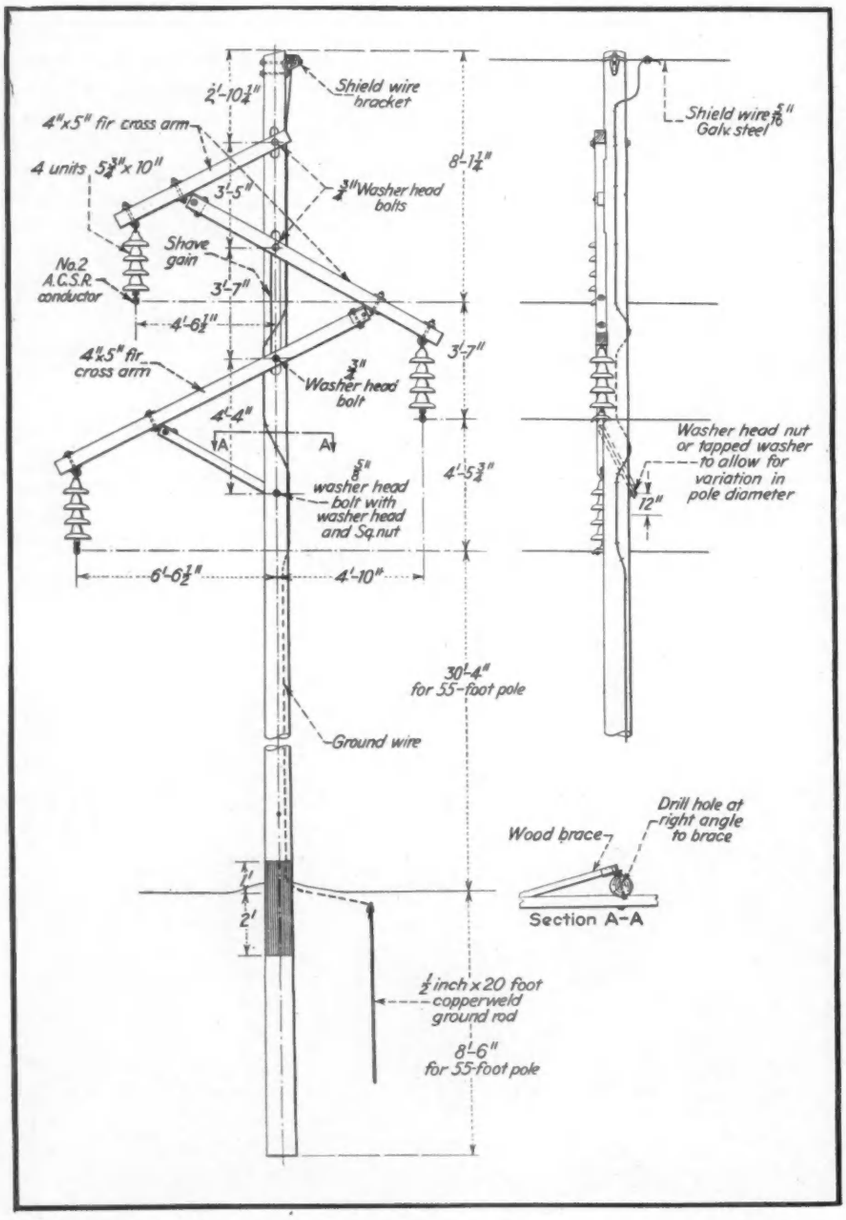


FIG. 9—General view of 11-kv. substation of type of Fig. 8

Modified Wishbone Arms Mitigate Storm Troubles

Severe sleet and wind conditions in an area difficult to patrol in winter led to novel wishbone-arm design for 69-kv. wood-pole line to keep conductors from contacting during storms — No two conductors are on same horizontal or vertical plane

B. H. CLINGERMAN and E. B. DOESCHER,† Northern States Power Company, Minneapolis, Minn.*



STRUCTURAL details of wishbone-arm construction

THE St. Bonifacius-Navarre 69-kv. transmission line, recently constructed by the Northern States Power Company, incorporates several features not previously utilized in the transmission lines of the company. The line, which is approximately 11 miles in length, extends from the St. Bonifacius 69-kv. switching station northeasterly to the Navarre substation, where electric energy is transformed from 69 kv. to 4 kv. for distribution in the rapidly growing Minnetonka Lake district, about 25 miles west of Minneapolis, Minn. Limited width of the right-of-way available for this line was an important factor in the choice of a single-pole type of construction.

Sleet storms have occurred rather regularly in this area. High winds occur frequently throughout the year, often accompanied by lightning storms in the summer and heavy snow in the winter. A single-pole line was required which would be reasonably free from outages at all times, especially during the winter months, when it is exceedingly difficult to patrol the transmission lines in this area.

Impulse-flashover characteristics of the proposed design were given first consideration since this feature governs the location of the shield wire and top phase wire. The angle of shielding on each side of the pole is 30 deg.; that is, the vertical angle formed by the conductor with the shield wire and pole is 30 deg. Air-gap distance between phase wires and shield-wire grounding lead was found to be the governing factor in impulse-

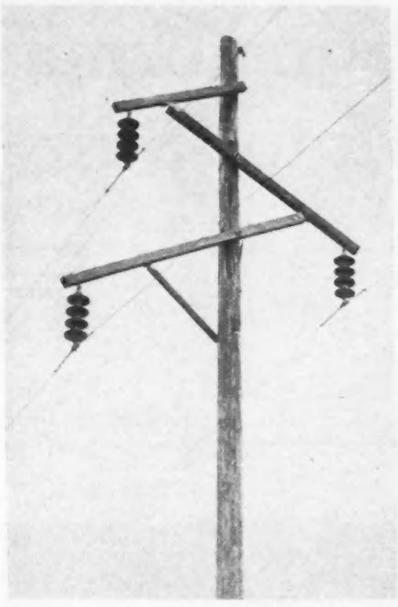
* Chief electrical engineer in charge of engineering department. † Transmission engineer.

insulation strength and was made as large as economically feasible for a single-pole line. Wood crossarms were chosen to increase the impulse flashover value of the structure. Four 5¾ x 10-in. porcelain insulator units per string were chosen on a 60-cycle basis, thus keeping over-all length of the insulator string as short as possible. Length of insulator string is a factor that determines the air-gap distance between conductor and shield-wire grounding lead, when the insulators swing toward the pole. To obtain maximum length of air gap the shield-wire grounding lead is located on the side of the pole furthest away from the nearest conductor.

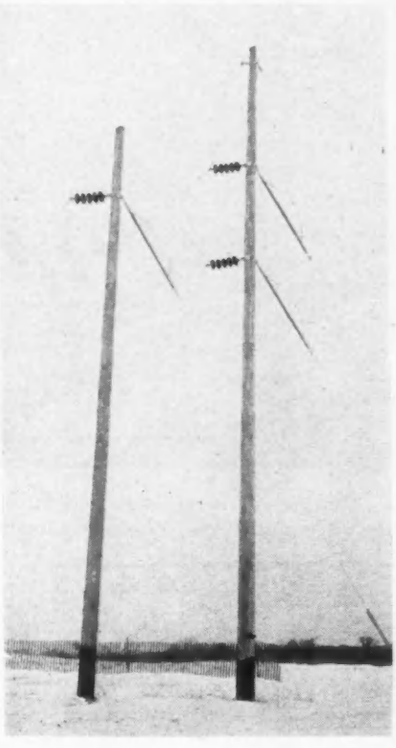
Contact Minimized

Two lower conductors were located so as to minimize the chance of phase-to-phase contacts during storms. The arrangement adopted avoids placing conductors in the same horizontal or vertical plane. In the chosen arrangement the lowest conductor is offset 2 ft. from the vertical plane in which the upper conductor is located. This configuration is especially desirable at times when ice is becoming detached from the wires; also during periods of dancing conductors. Clearances shown in the accompanying illustration were believed to be the maximum which could be economically justified by local conditions. Experience with other lines having a triangular configuration has shown that conductor contacts due to dancing conductors are less likely to occur when the side of the pole carrying the two phase wires is placed on the windward side of the prevailing winds. Prevailing winds are from the north and west in the area through which this line was constructed.

Douglas fir crossarms were chosen for this line. The crossarms were fabricated in the manufacturers' shop and each crossarm assembly was shipped to the job in four units, fully equipped with steel fittings, bolts, washers and lock nuts. All of the metal fittings were tapped. Bolts were of the washer-head type and all washers were tapped. Pole-line hardware which utilizes tapped washers and tapped metal fittings has been used by the Northern States Power Company for more than eight years. It has not been necessary to retighten this type of hardware and in no case has it been found to be a source of



CLOSE-UP of crossarm details



ANGLE structure

radio interference. Radio-interference tests were conducted when the St. Bonifacius-Navarre line was energized and as far as could be determined there was no noticeable radio interference caused by either the hardware or the insulators.

The crossarms are nominal 4 x 5-in. Douglas fir and the lower brace is 2 x 3-in. Douglas fir. Crossarms are bolted to the face of the pole and the brace is bolted to the back of the pole. This method of attachment, with the brace bolted to the back of the pole, results in a rigidity of the structure which tends to prevent overstressing of the crossarm bolts due to dancing conductors and in some cases may actually prevent dancing conductors.

Erected Assembled

Poles are Western red cedar 50 to 75 ft. in length. Class 4 poles were used on the west end of the line and Class 2 on the east end, where a future sub-circuit may be added. Poles were drilled and framed in the field. Gains were cut with a draw shave and extend 6 to 8 in. above and below the arm to allow for drainage. Gains were cut from 1 in. to 3 in. wide, depending upon the diameter of the pole. Poles installed upon railroad right-of-way were loaded on the cars by the supplier in accordance with a loading chart and were unloaded at the proper location directly from the cars by a locomotive crane which was supplied by the railroad company on a rental basis. All material, with the exception of the conductors, was attached to the pole before it was raised. The poles were raised by a "crawler-type" tractor equipped with a boom, winch and digging auger.

Angle structures are of the type shown in an accompanying illustration and consist of two poles adequately guyed. Insulators are installed in each guy with the exception of the upper guy, which serves as the ground connection for the shield wire. The upper guy is connected to driven electrodes installed adjacent to the anchors.

Driven-Grounds

The shield wire is grounded at each structure by a ½-in. diameter Copperweld rod in sections coupled together with extra-heavy couplings. Rod is equipped with a helical driving point and was driven by a "Rotodrive" machine. Depth of ground rods varies from 12 to 72 ft., with an average depth of 23 ft. per structure. Sixty-cycle ground resistances of 2 to 17 ohms per structure were obtained. Average resistance per structure was 8 ohms at the time of installation. Tests made in connection with a substation project at the time rods were driven, and again some months later, showed a marked decrease in resist-

[*Continued on page 130*]

Wire and Transformer Size to Prevent Motor-Start Flicker

Nomograms fix the size of secondary or service when the motor and transformer characteristics are known or estimated

S. LUBIN,* Rural Electrification Administration, Washington, D. C.

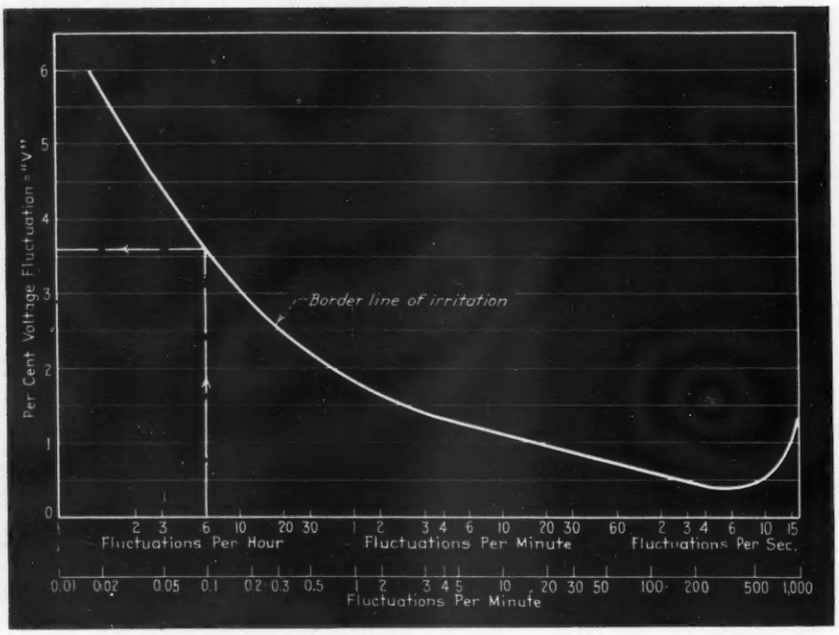
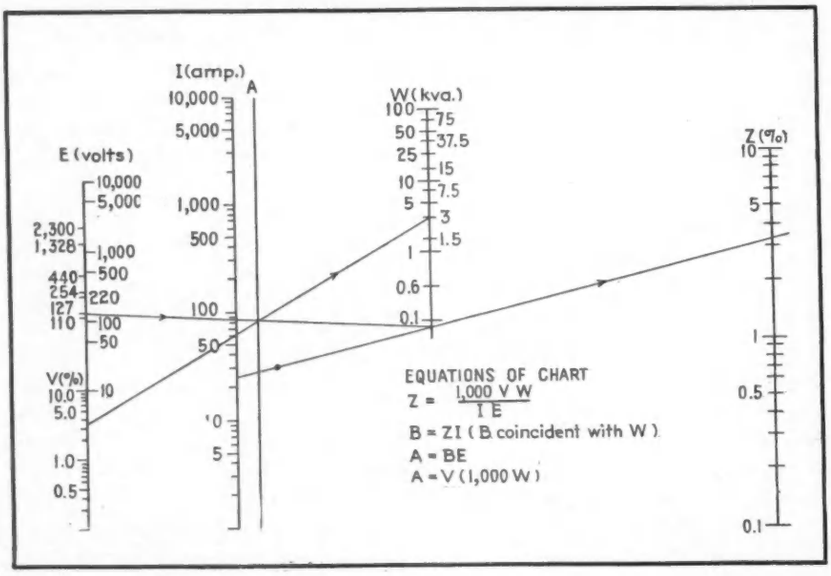


FIG. 1—Allowable percent of voltage flicker. This border line curve of irritation is reproduced from an article by H. A. Holmes in "Electrical World," January 25, 1941.



GROWING USE of medium-sized and large-sized motors on rural distribution lines and the increase in industrial load on these lines requires added attention to the problem of flicker. The solution presented here employs a set of nomograms which determine the proper secondary or service conductor size to be used when the motor and service transformer specifications and length of secondary or service circuits are known. The size of conductor determined from the charts is the proper size to prevent flicker, provided the primary regulation is sufficient to take care of the starting current. In cases where primary regulation is poor the value of the secondary supply voltage used in the calculations should take into account primary voltage drop due to the starting current.

It should be noted that due to the fact that in some cases this method may require the use of larger transformers than is customary for rural service some judgment should be used in its application. For rural systems the method need be applied

* Associate engineer.

FIG. 2—CONVERSION of allowable percent voltage. Fluctuation from transformer rating basis to actual load basis.

Z = Percent regulation in transformer and conductors
V = Allowable voltage fluctuation in percent (from Fig. 1)
W = Kva. rating of transformer
I = Motor-starting current
E = Supply voltage
1φ = Voltage between conductors
3φ = Phase-to-neutral voltagr = Phase-to-phase divided by 1.73

To find Z:
1. Use value of V from Fig. 1
2. Connect V and W. Mark intersection on A
3. Connect A and E. Mark intersection on W
4. Connect W and I. Read value on Z, which is allowable percent voltage fluctuation under actual load conditions.

only when motor loads are coincident with lighting loads. Applications such as water pumping, refrigeration and feed grinding would come under this heading, as, also, industrial plants and workshops using lighting during working hours. For loads normally in operation when lights are not in use it is recommended that transformer sizes be based on ordinary thermal considerations.

Prior Facts

Before the nomograms can be applied to the determination of conductor size the following information must be obtained:

1. Number of starts per hour, minute or second of the motor.
2. Make and size of transformer to be used.
3. The supply voltage (E) for the service or secondary.
4. The starting current (I) of the motor. (Where a current-limiting starting device is used the value of (I) should be the starting current when limited by the starting device).
5. The power factor of the motor at starting. In some cases manufacturers' specifications list locked kva. per hp. instead of power factor. This can be converted by taking:

$$\text{P.F.} = \frac{0.746}{\text{kva. per hp.}}$$

6. The length of the secondary or service circuits.

Fig. 1 is then used to determine the allowable percent of voltage fluctuation. The accompanying table gives the percent R and percent X of the transformer. Fig. 2 converts the allowable percent voltage fluctuation from the transformer rating basis to the actual load basis. Fig. 3 determines the percent voltage drop in the transformer and the percent resistance drop in the secondary or service conductor. Finally, Fig. 4 shows the conductor resistance in ohms per 1,000 feet, or the copper equivalent directly.

These charts are also useful, independently, for the solution of many

(*Continued on page 68*)

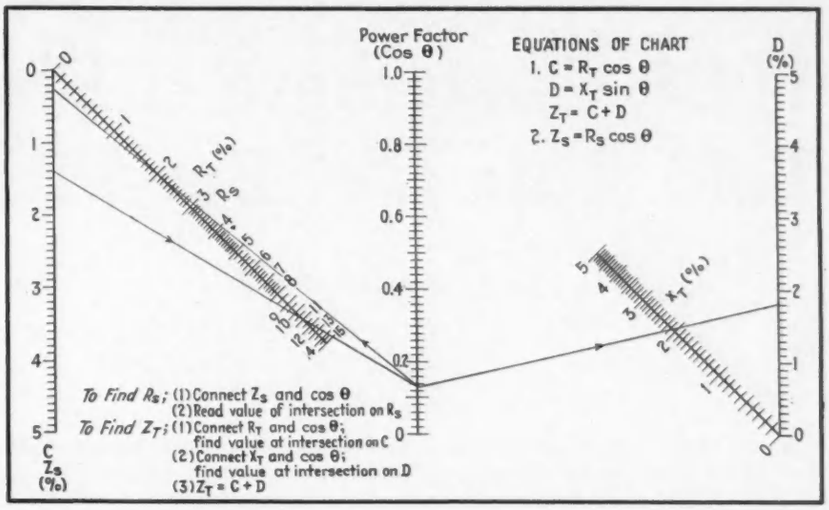

Power Factor (Cos θ)
EQUATIONS OF CHART
1. C = R_T cos θ
D = X_T sin θ
Z_T = C + D
2. Z_S = R_S cos θ
R_T (%)
R_S
X_T (%)
C
Z_S (%)
D (%)
To Find R_S; (1) Connect Z_S and cos θ
(2) Read value of intersection on R_S
To Find Z_T; (1) Connect R_T and cos θ; find value at intersection on C
(2) Connect X_T and cos θ; find value at intersection on D
(3) Z_T = C + D

FIG. 3—Percent voltage drop on transformer and percent resistance drop on the secondary or service conductor

R_T = Percent resistance of transformer
X_T = Percent reactance of transformer
θ = Power factor angle of motor at starting
Z_T = Percent regulation of transformer
Z_S = Percent regulation of service circuit
R_S = Percent resistance drop of service circuit

To find Z_T:
1. Use values of R_T and X_T from the table
2. Connect R_T and cos θ; find value at intersection on C
3. Connect X_T and cos θ; find value at intersection on D
4. Percent regulation in transformer, $Z_T = C + D$
5. Percent regulation in secondary, $Z_S = Z \cdot Z_T$

To find R_S
1. Connect Z_S and cos θ
2. Read value at intersection on R_S as percent resistance of service or secondary circuit

EXAMPLE

The following typical example is solved by reference to the four accompanying illustrations:

A 10-hp., three-phase squirrel-cage motor switches on and off six times per hour.

E = 220 volts, three phase = 127 volts, phase to neutral.
I = Starting current limited by starter = 75 amp.
= 25 amp. per phase.

Starting power factor = 0.13

W = 3 kva. Allis-Chalmers transformer
R_T = 2.08
X_T = 2.04
L = 1,000 ft.

From Fig. 1: V = 3.6 percent
From Fig. 2: Z = 3.5 percent
From Fig. 3: C = 0.28
D = 1.80
Z_T = 2.08
Z_S = 1.42
R_S = 11

From Fig. 4: r = No. 6 Cu.

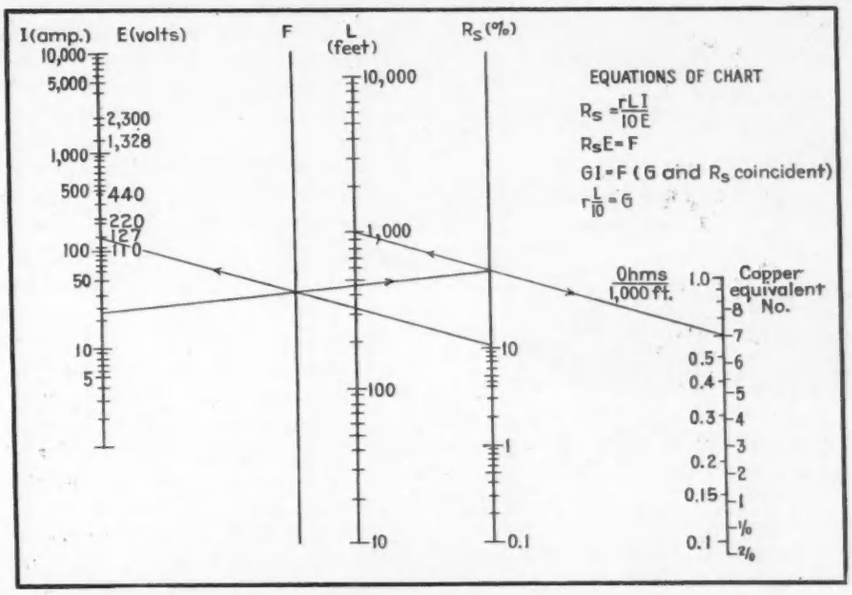


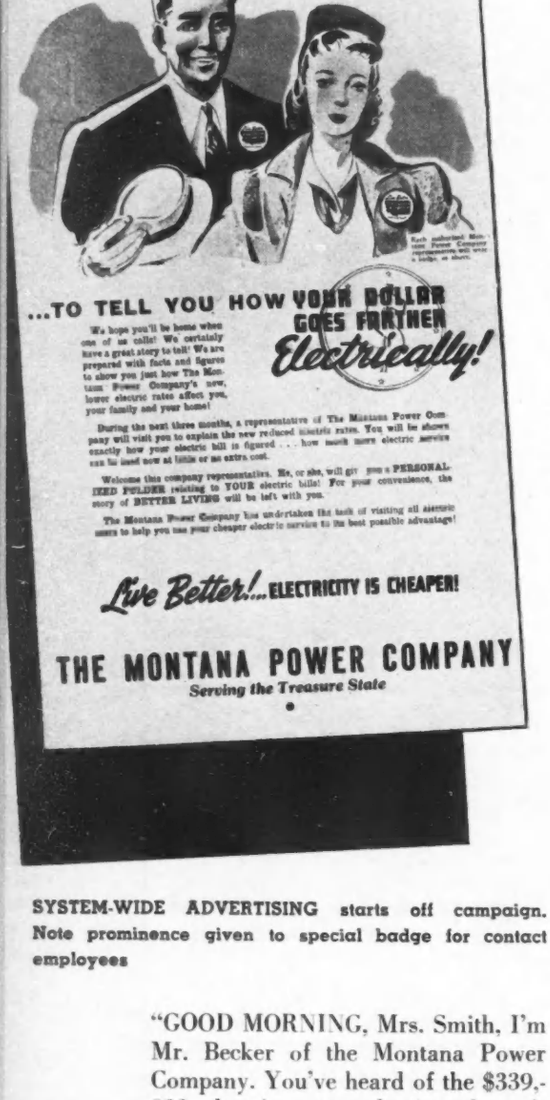
FIG. 4—Copper equivalent or conductor resistance on ohms per 1,000 ft.

R = Percent resistance drop in service conductor
r = Resistance of service conductor (ohms per 1,000 ft.)
L = Length of service circuit (feet) { 1φ = 2 × length of one conductor; 3φ = Length of one conductor
I = Motor-starting current
E = Supply voltage { 1φ = Voltage between conductors; 3φ = Phase-to-neutral voltage = Phase-to-phase voltage divided by 1.73

To find size of service conductor:
1. Connect R_S and E. Mark intersection on F
2. Connect F and I. Mark intersection on R_S
3. Connect intersection on R_S with L and extend to r line to find ohms per 1,000 ft. or copper equivalent

1,000 Customers a Day Told Rate Cut Benefits

Eighty-eight thousand Montana Power customers individually contacted in Better-Living Sales Campaign by 176 specially trained employees armed with consumption data and company facts secure leads for dealers and create customer good will


...TO TELL YOU HOW YOUR DOLLAR GOES FARTHER Electrically!
We hope you'll be home when one of us calls! We certainly have a great story to tell! We are prepared with facts and figures to show you just how The Montana Power Company's new, lower electric rates affect you, your family and your home!
During the next three months, a representative of The Montana Power Company will visit you to explain the new reduced electric rates. You will be shown exactly how your electric bill is figured . . . how much more electric service can be used now at little or no extra cost.
Welcome this company representative. He, or she, will give you a PERSONAL-IZED FOLDER relating to YOUR electric bills! For your convenience, the story of BETTER LIVING will be left with you.
The Montana Power Company has undertaken the task of visiting all electric users to help you use your cheaper electric service to its best possible advantage!
Live Better!... ELECTRICITY IS CHEAPER!
THE MONTANA POWER COMPANY
Serving the Treasure State

SYSTEM-WIDE ADVERTISING starts off campaign. Note prominence given to special badge for contact employees

"GOOD MORNING, Mrs. Smith, I'm Mr. Becker of the Montana Power Company. You've heard of the $339,000 electric rate reduction, haven't you? That's why I am here. My company has sent me to explain what the rate reduction means to you. May I come in? It will take only a moment."

With that typical introduction, 176 full-time and part-time salesmen, home service advisers, customer contact employees and local representatives of the Montana Power Company launched on May 15 of this year the most ambitious sales campaign ever put on by this utility, named the "Better-Living Sales Campaign." The object was to see 88,000 electric users (residential and commercial) within an 88-day campaign period. According to a recent statement by R. O. Kerr of the Montana Power Company, who has directed this unusual activity, "the staff has done an excellent job of maintaining a high rate of calls per day in accordance with the schedule we made at the start of the campaign. Seventy percent of the elapsed time of the campaign found 73 percent of the calls completed, and every man and woman engaged in the drive is exhibiting more than enough pep and enthusiasm to carry through the remainder of the task.

The $339,000 electric rate reduction was announced on May 1 through newspaper advertising and publicity in every city and town served by the company. This opening announcement was followed by a series of newspaper advertisements, direct-by-mail pieces, outdoor displays and radio spot announcements. This special advertising was designed to stimulate interest in the rate reduction and build acceptance among the company's customers for the contacts to be made by company employees. Appearing simultaneously with the beginning of the contact work, a system-wide newspaper advertisement carried the caption, "One of Us Will Call on You," and this was accompanied by an illustration of a man and a woman wearing the company's special campaign badge which identified them as authorized employees.

The next sentence in the typical customer approach ran something like this: "Mrs. Smith, I have here a personal presentation folder which I will fill in and leave with you. It relates to your electric bill and pictures for you the actual benefits you receive in your home under the new low electric rate."

Supplied With Data

Right at his fingertips the contact employee had all of the necessary data to talk intelligently and accurately to Mrs. Homemaker. Accurate data on each of the 88,000 customers to be contacted was taken from a customer card system which the company has maintained for several years. This customer card system, which consists of a series of colored customer information cards, is a by-product of machine billing and is produced with all of the following information at a labor cost of $1 per thousand and at the rate of 5,000 per day by one employee: Customer's name and address, route number, folio number, meter reading dates of the last bill issued and the number of kilowatt-hours used by this customer and the amount of the bill for the previous month.

In order that the contact employee could quickly shape his approach properly in accordance with the amount of use involved in each individual case, the cards were based upon a color signal system, with a different color for each rate block, as follows:

Red card—Minimum bill customer (15 kw.-hr. or less)

White card—5-cent rate block (16 to 50 kw.-hr. inclusive)

Goldenrod card—3-cent rate block (51 to 150 kw.-hr. inclusive)
Blue card—2-cent rate block (151 to 300 kw.-hr. inclusive)
Tan card—1½-cent rate block (all in excess of 300 kw.-hr.)
Buff card—All pro-rates and new "connects" during this billing period.

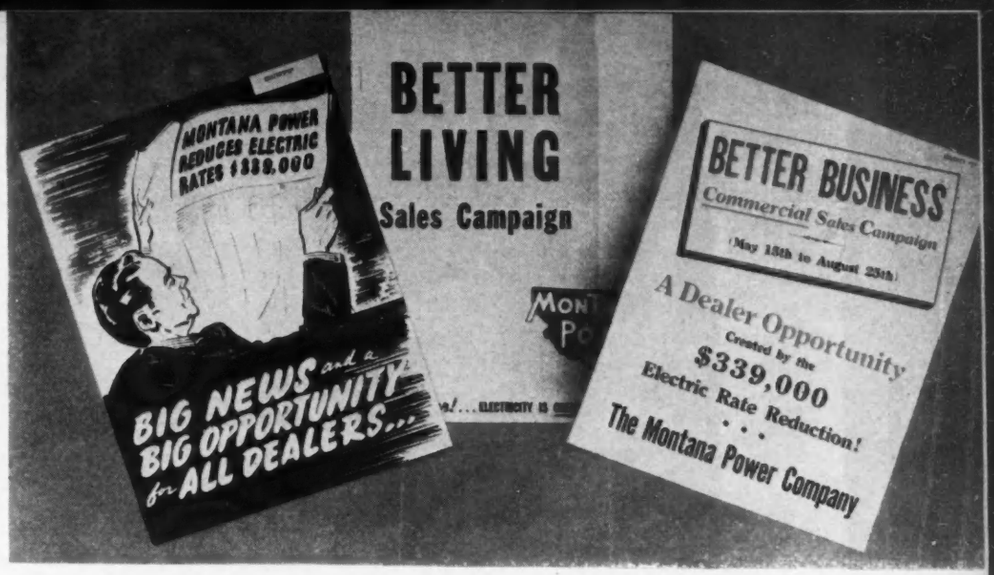
A simple routine was followed. The general office in Butte forwarded at frequent intervals to each district office an ample supply of cards properly filled out. The contact employees each morning were assigned a supply of these cards arranged conveniently by meter routes. After the call was completed the card became a report form to record important information about each customer obtained during the interview, such as the appliances in use, new appliances in which the customer was interested, and whether the customer's attitude was favorable or unfavorable toward the company. The cards were turned in each evening by the employee, names of prospects drawn off and sent to dealers on a prospect card.

In case the customer was not at home, a second call was made. If the contact employee was still unable to see the customer, the card was placed in an "Intermediate" file, the employee in the meantime having left a printed card under the customer's door explaining that he had tried twice to see her, that the company had some important information regarding electric rates and that this could be had by telephoning the company so that an employee could call.

Not only did this system work smoothly for the contact employees, but the finished file, when all calls have been completed, will provide the company with valuable data regarding its customers representing virtually all of its electric users.

The Better-Living campaign required special advertising, a basic employee sales plan book, or guide, special residential and commercial dealer plan books and residential and commercial presentation pamphlets.

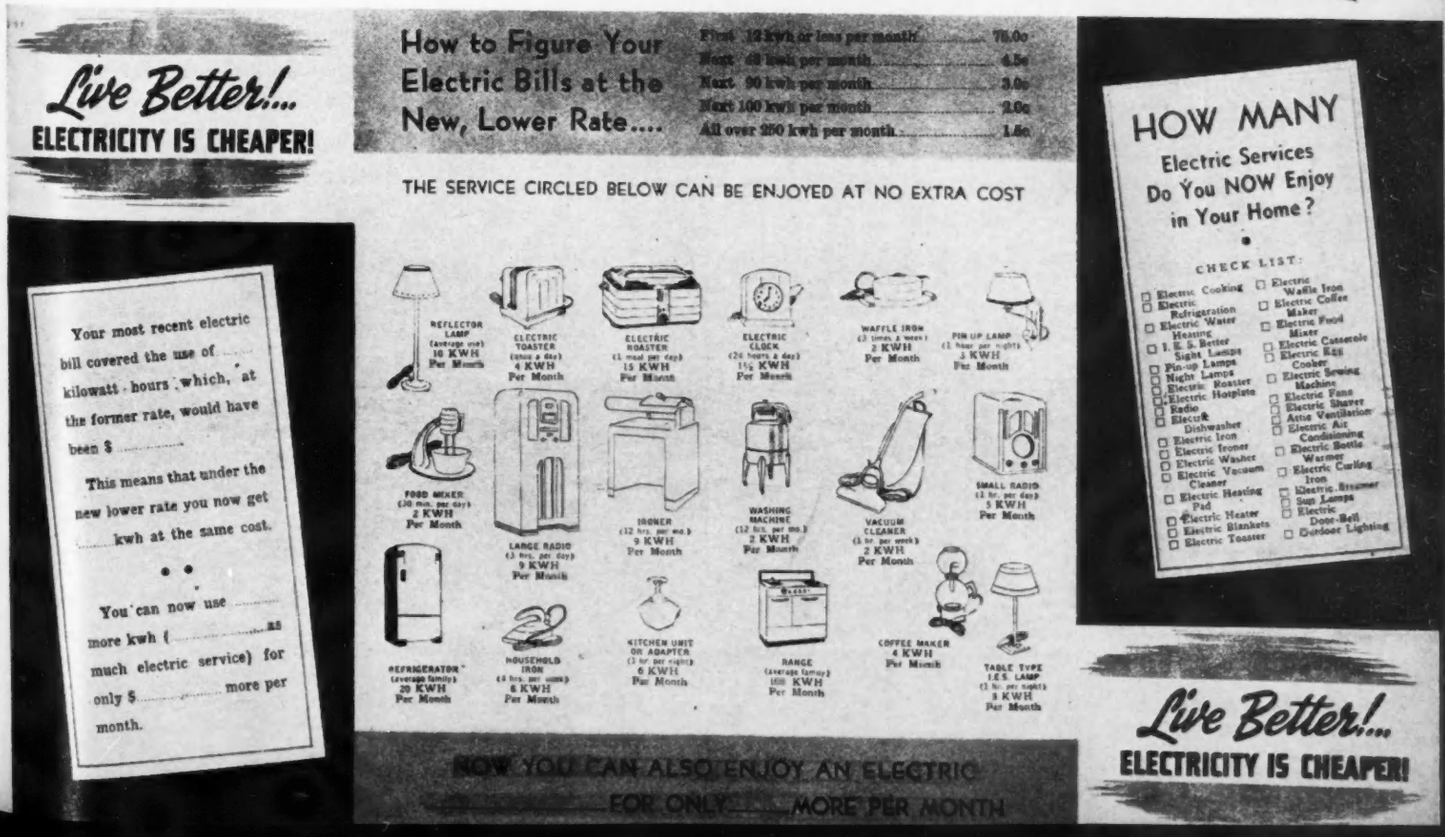
In order to conserve man-hours and to present most effectively the "Live Better—Electricity is Cheaper" story, all contact employees were col-



SPECIAL sales plan books and presentations for salesmen and dealers

PROSPECT CARD sent to dealers

FOLDER of facts left with each customer. There was a similar one, but in a different check list, for commercial customers


Live Better!...
ELECTRICITY IS CHEAPER!
How to Figure Your Electric Bills at the New, Lower Rate....
First 12 kwh or less per month ... 75.0c
Next 48 kwh per month ... 4.5c
Next 90 kwh per month ... 3.0c
Next 100 kwh per month ... 2.0c
All over 250 kwh per month ... 1.5c
THE SERVICE CIRCLED BELOW CAN BE ENJOYED AT NO EXTRA COST
Your most recent electric bill covered the use of ..... kilowatt-hours, which, at the former rate, would have been $ .....
This means that under the new lower rate you now get ..... kwh at the same cost.
You can now use ..... more kwh (..... as much electric service) for only $ ..... more per month.
REFLECTOR LAMP 10 KWH Per Month
ELECTRIC TOASTER 4 KWH Per Month
ELECTRIC ROASTER 15 KWH Per Month
ELECTRIC CLOCK 1½ KWH Per Month
WAFFLE IRON 2 KWH Per Month
PIN-UP LAMP 3 KWH Per Month
FOOD MIXER 2 KWH Per Month
LARGE RADIO 9 KWH Per Month
IRONER 9 KWH Per Month
WASHING MACHINE 2 KWH Per Month
VACUUM CLEANER 2 KWH Per Month
SMALL RADIO 5 KWH Per Month
REFRIGERATOR 20 KWH Per Month
HOUSEHOLD IRON 6 KWH Per Month
KITCHEN UNIT OR ADAPTER 6 KWH Per Month
RANGE 100 KWH Per Month
COFFEE MAKER 4 KWH Per Month
TABLE TYPE I.E.S. LAMP 3 KWH Per Month
NOW YOU CAN ALSO ENJOY AN ELECTRIC ..... FOR ONLY ..... MORE PER MONTH
HOW MANY Electric Services Do You NOW Enjoy in Your Home?
CHECK LIST:
Electric Cooking
Electric Refrigeration
Electric Water Heating
I. E. S. Better Sight Lamps
Pin-up Lamps
Night Lamps
Electric Roaster
Electric Hotplate
Radio
Electric Dishwasher
Electric Iron
Electric Ironer
Electric Washer
Electric Vacuum Cleaner
Electric Heating Pad
Electric Heater
Electric Blankets
Electric Toaster
Electric Waffle Iron
Electric Coffee Maker
Electric Food Mixer
Electric Casserole
Electric Egg Cooker
Electric Sewing Machine
Electric Fans
Electric Shaver
Attic Ventilation
Electric Air Conditioning
Electric Bottle Warmer
Electric Curling Iron
Electric Steamer
Sun Lamps
Electric Door-Bell
Outdoor Lighting
Live Better!...
ELECTRICITY IS CHEAPER!

lectively and individually coached by general office personnel. This proved effective as it resulted in the residential story being told in the field to customers in twenty-minute interviews on the average. The story as finally presented to the customer followed these steps:

1. Explain the kw.-hr.—what it is, what it will do and how it is purchased under the new rate as compared with the previous and other former rates.
2. (a) Impress the customer with the number of uses to which electricity is put in her home, so she will realize that her monthly bill is an all-service bill rather than a so-called light bill. (b) Reduce monthly bill to cents per day per service.
3. Contrast the kw.-hr. purchaseable under the new rate as against the old rate for the same amount of money.
4. (a) Sell the customers on the cheapness of additional use, and (b) show her how to figure her own bill. A theoretical consumption of "half again as many" or "twice as many" kilowatt-hours was actually figured under the new rate, and the total figure compared with what she paid under the old rate. This difference was further reduced to cents per day.
5. Explain kilowatt-hour consumption and operating cost of appliances in use or desired.
6. Highlight briefly company history, citizenship, taxes, etc.

There are several interesting sidelights in the Montana Power Company's Better-Living sales campaign which have developed to this point. For example, it was found that, by and large, customers did not know how to figure their own electric service bills. Specifically, the greatest cause for confusion in this respect was the inability of the average customer to apply the minimum charge. Up to the time the employee contacted the average customer the figuring of a bill was a mystery and the explanation won many grateful comments.

Cost in Pennies

Another point of interest was the explanation of the cost in pennies per month of the average appliance in the home. Employees reported that customers were actually astonished to learn the low cost of operating the various appliances. The customer had absolutely no conception of these costs and guesses were for the most part ridiculously high. Furthermore, the customer was dubious when told how little it would cost to double her present use of electric service. It was necessary for the contact employee to figure this out step by step with the rate table before him, before the customer would believe the figure.

Answering queries as to why the price of electricity varies from 4½ cents to 1½ cents per kilowatt-hour, employees gave a parallel which ran something like this: "Mrs. Smith, you know from your marketing experience that it costs less to buy in quantity. For instance, here is a recent quotation on potatoes:

5 pounds	15 cents
12 pounds	25 cents
25 pounds	45 cents
50 pounds	85 cents
100 pounds	$1.49

"You see the price per pound of potatoes in that case varied from 3 cents down to a little under 1½ cents. Thus the more potatoes you buy the less you pay per pound. So it is with electric service under your new low electric rate."

There was also found among the company's customers an unusual interest in the company's local citizenship and progress. Employees were armed with many vital, quick facts about the company which dealt with the history of its development, its interconnected transmission system which provides dependable service, the number of hydro-electric plants built and operated by the company, and the amounts paid out each year in taxes and wages. This information was printed on the last page of the personal presentation folder.

To quote Mr. Kerr again: "There is no question about the great amount of good which is resulting from this special campaign. Our customers like the idea that we are willing to take the time to explain their electric rates and the benefits they may receive from our service. We have met misconceptions with actual facts, and we have already felt favorable reactions from this method of dealing openly and frankly with our customers."

Wire, Transformer Size to Prevent Motor-Start Flicker

[*Continued from page 65*]

electrical distribution problems. For example, Fig. 2 can be used to find the regulation of an overloaded transformer when the regulation at full rated load is known. Fig. 3 computes the percent regulation of a transformer or a service circuit when power factor, percent R and percent X are known. It also gives directly the value of percent R when percent regulation and power factor are known, provided reactance is assumed to be negligible. Fig. 4 can be used to determine any one of the following: Voltage, current, length of a circuit, percent resistance drop, or resistance in ohms per 1,000 ft. when the other quantities are known.

Percent Resistance and Percent Reactance of Distribution Transformers*

Transformer Rating (Kva.)	Allis-Chalmers		General Electric		Kuhlman		Line Material		Moloney		Standard		Wagner		Westinghouse	
	% R_T	% X_T	% R_T	% X_T	% R_T	% X_T	% R_T	% X_T	% R_T	% X_T	% R_T	% X_T	% R_T	% X_T	% R_T	% X_T
1.5	2.37	2.08	2.60	2.19	2.86	1.67	3.06	1.48	2.73	1.67	3.06	1.90	2.25	1.31	2.87	0.88
3	2.08	2.04	2.27	2.24	2.46	1.60	2.73	1.80	2.40	1.80	2.80	1.50	2.26	1.80	2.26	1.96
5	2.25	1.79	2.20	2.18	2.22	1.91	2.50	1.99	2.42	2.10	2.57	2.44	2.20	1.99	2.00	1.32
7.5	2.00	2.21	2.15	1.79	2.27	2.33	2.27	2.25	2.27	2.34	2.33	1.72	1.81	1.69	2.08	1.88
10	1.85	2.25	2.00	1.96	2.17	2.63	2.17	2.36	2.02	2.26	1.95	2.34	1.83	2.11	1.90	1.63
15	1.53	2.24	1.72	2.21	1.78	2.82	1.78	2.66	1.82	2.87	1.82	2.48	1.65	2.29	1.68	1.85
25	1.42	2.57	1.51	2.36	1.60	3.19	1.60	2.78	1.53	3.14	1.67	2.90	1.36	2.88	1.47	2.73
37.5	1.32	2.79	1.31	2.47	1.38	3.61	1.38	2.89	1.35	2.90	1.49	2.80	1.20	2.88	1.39	3.03
50	1.16	2.91	1.22	2.52	1.04	3.80	1.34	2.91	1.38	2.96	1.34	2.90	1.08	3.30	1.29	3.37
75	1.09	2.64	1.10	2.47	1.25	3.36	1.25	4.84	1.31	3.10	1.21	3.68	1.16	3.44	1.20	4.80
100	1.13	3.07	1.12	2.46	1.23	3.46	1.23	4.84	1.24	3.10	1.26	3.80	1.07	4.41	1.22	3.96

*Rating from 1.5 kva. to 15 kva. inclusive are REA type. Rating of 25 kva. and above are conventional double bushing type.

Condenser Kvar Source Surpasses Idle Hydro

Corrects voltage on 13.8-kv. bus — Started by one-step Korndorffer connection method — Furnishes heated air for substation

VINCENT J. HAYES,* Connecticut Light & Power Company, Waterbury

SEVERAL features of the recent 15,000-kva. synchronous condenser installation at the Baldwin Street substation of this company in Waterbury are of interest to the engineer, these being more or less related to the housing of the unit, its service reliability and flexibility of operation. The condenser, a Westinghouse machine rated at 14 kv., and running 900 r.p.m., saves about 900 kw.-hr. per hour of use in losses over the customary employment of hydro-electric generators for the purpose of furnishing kvar. Since the losses attendant to the use of these various units for reactive supply represent power from steam plants or the use of water from storage, the savings to be achieved by substitution of a synchronous condenser are shown by the total hours of operation and the difference in the costs of power necessary to supply the 15,000 kvar.

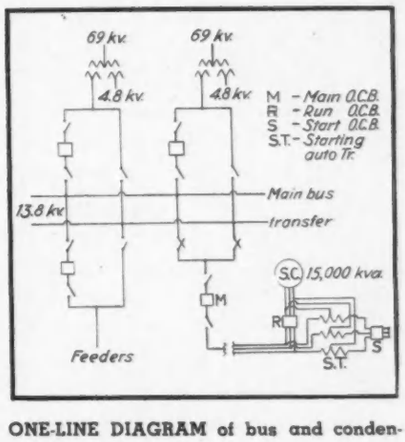
* Assistant engineer, general operating department.

The condenser can be operated on either the main or the spare 13.8-kv. bus at this substation. Since there are two 18,000-kva. transformer banks between the 69-kv. supply and these 13.8-kv. buses, the switching arrangement installed enables the condenser to be run on the main bus for its voltage correction if necessary, or on the spare bus for system power-factor correction when operating conditions require its steady full capacity. The voltage regulator and its controls are provided with means of operating the condenser as a voltage regulator for the 13.8-kv. bus or as a means of supplying a fixed predetermined reactive load.

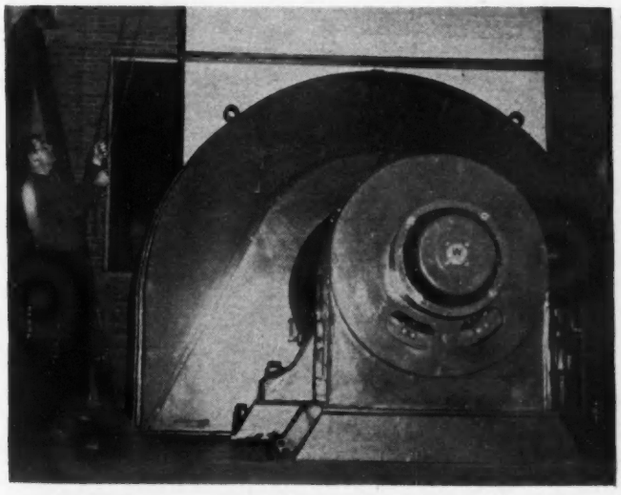
Starting of the condenser is accomplished by means of a starting autotransformer utilizing the one-tap Korndorffer connection method, using about 20 per cent of rated full voltage to reduce the starting inrush of current. In the starting position, with the run breaker open, the starting breaker closes the neutral of the starting transformer and applies this reduced voltage to the condenser. When the latter comes up to speed the starting breaker is opened and the run breaker is closed (shorting out about 80 per cent of the starting transformer windings), thus applying full voltage to the unit. Two oil circuit breakers are used in the main supply and starting breaker positions, and a 15-kv. Deïon air circuit breaker is used in the running breaker position.

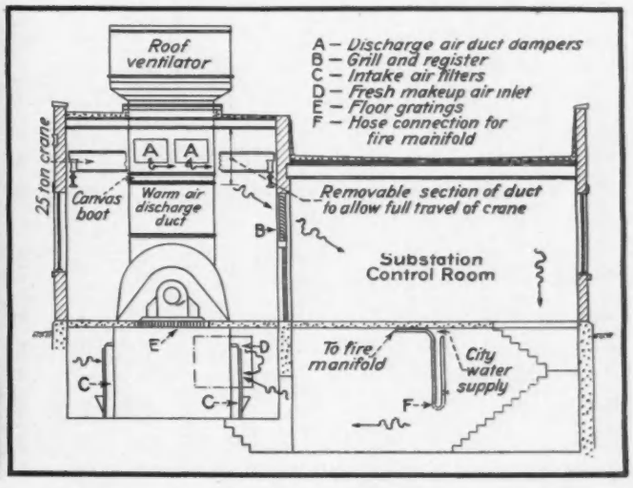
Sequential operation of these breakers is obtained by electrical interlocks to prevent improper starting of the condenser. These interlocks also include means for prevention of closing the starting breaker if there is not an adequate lifting oil pressure on the shaft at the main bearings. An eight-point recording temperature indicator is used to give winding, bearings and cooling air temperatures, the instrument being provided with three adjustable alarm contacts to give indi-

[*Continued on page* 137]



ONE-LINE DIAGRAM of bus and condenser switching layout





DUCT SECTION above condenser is removable to allow full crane travel (left). Cross-section of housing facilities, showing ventilation scheme (right)

Editorials

S. B. WILLIAMS, *Editor*

Power Rationing Can Play No Favorites

FOUR MONTHS AGO the Southeast, because of a water shortage, had to undergo a brief period of power rationing. Shortly, when the rains came, the necessity seemed to have passed and restrictions were removed. The rains were only temporary, however, and another program of kilowatt-hour conservation appears to be impending. Will it be the same kind of a voluntary acquiescence, with compliance confined very largely to private power companies and their customers, or will observation of rationing be enforced, irrespective of ownership and contracts?

There is testimony in the conservation of water power during this Southeastern drought that should cause proponents of political management to reconsider their advocacy. There wasn't a single privately owned utility in the area that could not have gone through this drought without recourse to rationing had it not been required to export power to Tennessee to maintain aluminum production. It might be said also that TVA could have carried its load without getting into trouble had it not been using so much of its water to serve an aluminum load far beyond its contract. Nevertheless, there was an obligation of national importance that transcended contractual obligations and the Authority did its part, and at the same time the private companies in the area assumed a part of that obligation at some sacrifice in revenue.

When it became apparent that there weren't enough kilowatt-hours to go around, and resort was made to voluntary rationing, it was not along the lines of systems with the secondary obligation that the great volume of non-compliance occurred, but in Tennessee. Large cities, wholesale customers of TVA, ignored the emergency and defied the Authority under threat of legal action to depart one iota from its contractual obligation. Maybe TVA was in a position where it couldn't do a thing. Nevertheless, it cannot escape unfavorable comparison with the private companies that by all-out effort secured compliance in their territories, notwithstanding the fact that they also had contractual relations with municipalities.

Fortunately, the duration of the immediate emergency was short, so that the unfair advantage that was taken of those who voluntarily complied did not bring any protracted hardship. Short as it was, however, it was enough to serve notice that there would be no more voluntary compliance without the assurance that the burden would fall equally on all, wherever located within the affected area.

Since that time the power branch of OPM has been given more authority over power. We feel certain that it will recognize the fairness of the point of view of those who complied before and will not permit any customer or city again to disregard a curtailment order. In fact, it is only on that basis that it can again expect widespread cooperation of utilities and their employees in selling and enforcing compliance among their customers.

Material Salvage Takes on a New Aspect

SAVING of money by avoidance of purchasing new things is becoming a secondary object in electric utility salvage operations. Apparent now, and soon to be the prime consideration, is the need for conserving in usable shape all the used materials and equipments required for electricity systems. The economy of discarding the old and replacing it with the new is losing cogency as difficulties increase in obtaining the new and salvage thus takes on a new aspect.

It may be good economy to replace an old transformer, circuit breaker, boiler or what-have-you in view of the improvements incorporated in new forms. It may cost more to rehabilitate than to buy new. But what if one can't get the new when one needs it or perhaps can't get it at all? Another consideration is the compulsion to refrain from burdening manufacturing capacity with demands not altogether necessary to our defense effort and that can be deferred.

These are the reasons why salvage operations are becoming larger in many electric utilities and are tending more and more to have other justification than the economic. In the stress of conditions money economy must take a place second to the economy of materials and of products.

Probably certain difficulties of operation will be perpetuated or reintroduced by the continuation in use or the reuse of devices and equipments that would heretofore have been considered to be ready for discard. But in many instances the rebuilding or rehabilitation of these items of property can furnish occasion to incorporate improvements of later designs, thus to avoid or to mitigate deficiencies of the original forms. This possibility is a challenge to utility engineers, to their ingenuity and to their knowledge of late developments in equipment design. With full advantage taken of it, the addition of new developments to older forms will do much to forestall operating difficulties.

"Making things do" is bound to become a larger

practice in electric utility engineering. How well they are made to do will be a measure of the ability of electric utility engineers.

Barriers to Integration Under Utility Act

FROM TIME TO TIME it has been rumored that in the course of compliance with the Holding Company Act certain properties would be swapped or sold. The moves looked logical in a program of geographic integration. But it isn't as easy as all that. Besides the problem of unscrambling security ownership there are other problems which have barred changes in property ownership.

In a recent case, for instance, a property had not adjusted its fixed capital account to conform to FPC's original cost orders. This gave rise to two difficulties. First, if the plant account were written down or adjusted to original cost there would be no fixed property behind the common or preferred. Secondly, if the property were taken over, then the purchaser would have to assume this adjustment, to the detriment of its own property account.

That is one of the difficulties in the path of transfer of ownership to another holding company. However, when the case is exactly the opposite another equally serious difficulty arises. Where an operating property has been very conservative and has built up equities behind its stock, and which it carries at very conservative prices on its books, a change in ownership involves a large tax settlement. The more conservative the company, the bigger the tax.

Then there is a third barrier to integration by transfer, and that is the new tax bill. Properties that a year or two ago might have been worth acquiring from the standpoint of producing net are no longer attractive buys.

In the meantime SEC is going ahead with hearings and issuing orders, but with the knowledge that problems like these are in many cases going to prevent the carrying out of its orders until conditions are more propitious.

Load Salvaging

AS THE available stocks of appliances become smaller one can expect to see more and more attention being given to appliance maintenance to lessen load mortality. While a great many companies have been doing this sort of work through the home service girls, there has been a disinclination to engage in appliance maintenance on a large scale because of the cost and because of the difficulty in collecting for work done. Also, when the sales of new appliances were going ahead nicely there wasn't the same incentive to hold every little bit of load.

Now it begins to look as though it might be desirable to salvage load whenever possible. But how can it be done effectively and at a cost that is not prohibitive? How much is too much? What proportion of one year's revenue from the salvaged load can one afford to pay to get it? What form shall the activity take? Will participation by contractors and repair shops be encouraged?

These are but a few of the questions that are running through the minds of commercial managers. It is to be hoped that answers to many questions will be found in some recently started residential load-salvaging programs. In the meantime, if other companies would engage in experimental approaches to this market the combined results would be invaluable to all.

If other things can be salvaged profitably, why not load? It may be necessary to employ a "junk" man or to set up a salvaging department with "junk" costs. Whatever it is, the results should be worth while, at least during a period of reduced volume of new appliances.

Kansas City Strikers Betray Utility Employees

ON SEPTEMBER 16 in Kansas City doctors gave two-year-old Herbert ("Tex") Schneider a 50-50 chance to live. After five days in an iron lung Tex had a fighting chance—a sporting chance to beat infantile paralysis; to breathe like other children—a 50-50 chance to be a man.

Less than a day later the doctors said—"maybe." Because while Tex fought his one-sided battle for a chance at manhood a group of irresponsibles in a power plant not far away pulled switches and left posts of duty in a sudden, vicious jurisdictional strike. The willful blackout that followed deadened the respirator that had kept the two-year paralysis victim breathing. Fortunately, two nurses working in the light of a candle kept breath in his body, using artificial respiration, until an emergency generator could be rushed to the hospital.

It must have come as a blow to light and power company employees all over the country that this proud industry, famous for the faithfulness and heroism of its men in disaster, could be betrayed by men within its ranks craven enough to jeopardize willfully the lives of others to win a selfish advantage.

The story of this strike has spread all over the country and nothing has done more to destroy public confidence in the soldier-like attitude of utility employees toward the maintenance of service.

The public must be reassured, therefore, that all but a mere handful of its public utility servants are men conscious of their heritage of service and ready for whatever the maintenance of that service may entail. They settle their differences like men—fairly and without the bargaining force of blackout-out cities and deadened respirators, and without prejudice to the continuity of service they represent. These, the majority, will absorb and purify the minority, but seldom in the history of this industry have so few brought such shame to so many.

Washington Comment

By GEORGE E. DOYING, Jr., Washington Correspondent

Allocations to Head Off Priorities Scrambles

ALLOCATION is the new key-word in priorities. SPAB Executive Director Donald M. Nelson is formally on record, before the House committee studying the price control bill, with the statement that priorities "sights" must be reset. Allocation of raw materials to specific industries and for specific purposes must take over where individual priority certificates passed by manufacturers down through suppliers are failing.

This is Nelson's recipe for eliminating, or at least lessening, the constant scramble which now goes on among producers for more and more, higher and higher ratings. This scramble is caused, in turn, by fear that needed materials won't be available at the right time. It leads to hoarding, to inventory stocking, to a host of other subterfuges, all working directly for making scarce materials scarcer.

"We've got to have a system that will make absolutely sure our delivery dates," said Nelson to the House committee.

Will Take Time

Nelson believes that allocations will provide that guarantee where priority certificates will not. Under an allocation system (which really works) manufacturers will know exactly how much controlled materials they will get for a given purpose, and when they will get them. Priority certificates aren't guarantees—rather they are "rights" to certain quantities of materials. And when there are a huge number of these "rights" outstanding, as there is today for steel and copper and zinc and aluminum and all the rest, sometimes the certificates aren't worth the paper that they are printed on.

All this isn't going to happen overnight. You won't wake up some morning to find that priority certificates are abandoned. Rather it will be a gradual (although in the circumstances probably quite rapid) changeover in emphasis of control, in reality a continuation of an evolution which is now in progress.

Even now all of the metals and an increasing number of other raw materials are under priority control as to distribution of supplies. First processors of such commodities as aluminum, copper, zinc, etc., are under direct supervision of the Priorities Division and submit, monthly, their order books and delivery schedules. In some instances the Priorities Division directs modification of a delivery schedule, even to ordering the filling of a lesser rated or unrated order ahead of those with higher preference certificates.

Lump Allotments

There will be an ever-increasing amount of this reshuffling of deliveries as the swingover to allocations develops. The Priorities Division will implement this by directing lump sum allotments of certain materials for specific industries in advance of the sifting down of priority certificates. Thus, for instance, when it is determined the amount of zinc shell manufacturers will need for, say, the next three or six months to maintain production schedules, that amount of zinc will be earmarked. Shell makers will be able to draw against the pool as needed, perhaps showing nothing more than a certificate of eligibility or filing an affidavit.

Materials for utility expansion will go under this system when it gets going, in all probability. The Priorities Division, working with OPM Power Coordinator J. A. Krug, under this procedure, will allot specific quantities of materials to manufacturers of generators, turbines, conductors, etc., to meet the production needs of the industry. The manufacturers then draw from the allotments to fill specific orders which have the approval—evidenced by project ratings or some other document—of Krug's office.

The idea is that this takes the "chance" out of getting required materials, and takes the risk out of fulfilling orders on the specified delivery dates. As a result, manufacturers should be able to operate with thinner inventories and will not feel the urge to provide themselves a "cushion of safety" in scheduling delivery dates.

Switching to raw materials rationing by allocation is a natural sequence growing out of the manner in which the Supply Priorities and Allocations Board has buckled down to its job of assuming over-all defense responsibility and authority. One of SPAB's first actions was to direct Nelson to compile total schedules of defense and civilian requirements in terms of materials, men and machines as far ahead as possible.

Total Picture Now

Strange as it may seem, this is a job which hasn't before been done in any comprehensive way. Individual agencies have taken a flier at it for individual commodities, such as the Federal Power Commission's power requirements and supply studies. But no one has assumed responsibility for a total picture, until now.

Nelson is engaged in this job today; it'll take most of the fall to add up all the totals, American defense, British lend-lease, aid to Russia and other democracies, essential civilian and other civilian. But the SPAB statisticians are out for an honest figure of what would be if there were no government controls.

Then, SPAB can segregate into the three categories the requirements for the war program, for essential civilian operation and for "other civilian operation." There isn't, yet anyway, any exact definition for those two civilian categories. This much can be stated with certainty. Public services such as electricity are rated as "essential civilian" and SPAB is working on the stated policy that the demands of military and essential civilian requirements "must be equally recognized and adequately provided for in allocated materials" to the end that civilian life is maintained "in good

[*Continued on page* 122]

NEWS OF THE WEEK

Three-Year Amortization Plan Developed by FPC

Niagara Falls Power Co. required to set up special accounts for defense facilities and allowed 6 percent return and amortization on specific capital expenditures

Complete amortization over three years of new capital expenditures necessary for utilizing temporary extra Niagara water diversion for defense power is provided by the Federal Power Commission in its first case directly involving war expansion investment. The order also directs impounding net income resulting from the extra energy sales in excess of a 6 percent return on the company's capital expenses for use in reducing the net investment.

The commission's order authorizes amendment to October 1, 1942, of the license of Niagara Falls Power Co., to permit the use of 5,000 additional second-feet of water to develop 64,100 kw. for distribution, as directed by FPC, among plants with defense business.

Set Up Sub-Accounts

The company is required to set up sub-accounts on its books showing the incremental or out-of-pocket cost of additions to, betterments of and rehabilitation of its licensed hydro project required for generation, transmission and distribution of the "defense power" and "defense kilowatt-hours" from the additional diversion.

The company is also required, monthly, to compute the revenues received from and the cost of generating and distributing this extra power. Revenues include all payments by defense industrial users and 3 mills per kilowatt hour for all energy from the additional diversion furnished to other than the defense consumers. Costs include additional out-of-pocket generation, transmission and distribution expenses, consumers' accounting and collecting expenses, administrative and general expenses, a reasonable apportionment of similar indirect costs, taxes and contributions, and an amount sufficient to amortize, within three years, the special capital expenditures.

The company is finally required to credit to a special account any excess of revenues over costs plus a return of 6 percent on the special capital expenses. Any portion of the capital expenditures unamortized when the additional diversion is terminated, less salvage value realized by the company, is to be charged against this special fund. Any excess in the fund after this possible charge-off will finally be credited to the company's amortization reserve-federal account for reducing the net investment in the whole project.

Net result of this procedure is that defense power users will pay the cost of additional investment in full if the war lasts three years or longer. If it lasts less than that period the company will be reimbursed from a reserve fund which, if not needed, will be used to reduce the company's investment in a project ultimately subject to recapture by the government. At the same time the company is denied profits resulting solely from additional generation in which it has no capital stake, while assured of 6 percent return on its own contribution to this emergency operation.

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OPM Orders 45 Percent Cut in Refrigerator Output

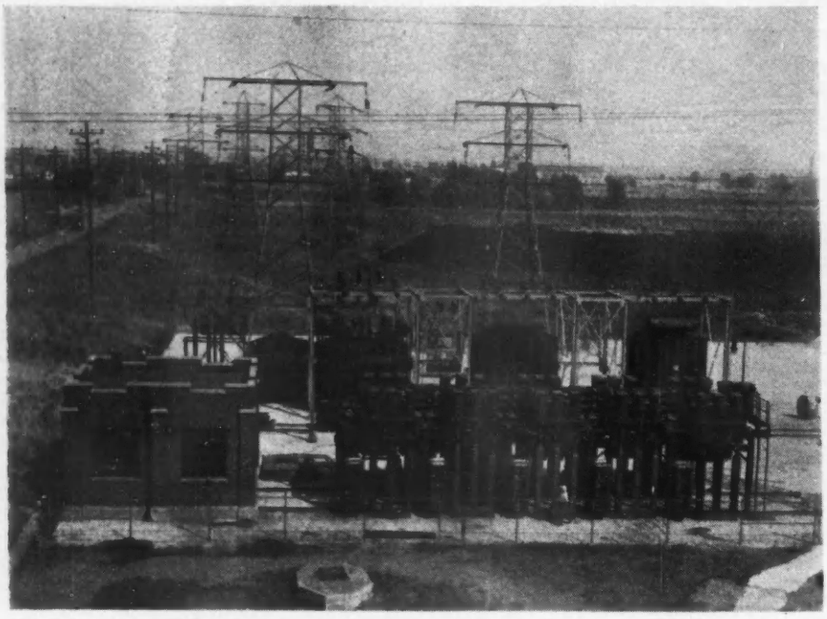
The 45 percent slash ordered this week in production of mechanical household refrigerators is the first of a string of limitation orders which will come promptly from OPM's Priorities Division. Virtually all consumers' durable goods, including electrical appliances, are to be put under similar control, with washing machines likely to be next in line.

This means that decision finally has been made to limit output of the end product rather than to allocate to manufacturers specific quantities of metals and let individual ingenuity make the most of them. OPM's idea on this point is to "freeze" competitive position and to prevent technical ingenuity from being focused into consumer rather than defense fields.

The refrigerator order sets up a specific end-product quota for three classes of manufacturer, big, medium and small, during the five months August 1, 1941, to December 31, 1941.

Class A manufacturers are those whose *average* monthly factory sales during the year ended June 30, 1941, were 16,000 units or more; Class B are those whose average was more than 5,000 units but less than 16,000; Class C are producers whose average was 5,000 units or less. The five-month quotas for these classes are: A—50,400 refrigerators, or five times 55 percent of the base monthly average, whichever is *higher*. B—17,750 refrigerators, or five times 63 percent of the base monthly average, whichever is higher. C—Five times 71 percent of the base monthly average.

The order simply sets up production



MONSANTO SUBSTATION—Three underground feeders now connect Monsanto substation with Cahokia, through 14,000 f.. of duc.; cooling fans have been installed and a fourth transformer added as a spare

quotas; it does not extend priority assistance to manufacturers with which to obtain materials to be used in operating up to the limits. It further stipulates that manufacturers must not accumulate "excessive inventories" of raw materials, semi-processed materials, finished parts or assembled units. Monthly reports of inventories must be made to the Electrical Appliance and Consumers' Durable Goods Branch of the Civilian Supply Division, together with a statement of the number of refrigerators produced in the preceding two months, by models.

The total of these quotas, as estimated by OPM, is 175,519 units monthly during the August-December period, or 2,007,000 in a year compared to 3,670,000 units in the year ended June 30. This is 43.2 percent under the average monthly factory sales in the year ended June 30 and 20 percent less than the average in the year ended June 30, 1940.

Determination of the quotas beyond December 31 will be made later, Donald M. Nelson stated, when there is a clearer picture of the amount of scarce materials which are to be permitted to go into civilian production. That quotas in 1942 will be less than those now set is considered a foregone conclusion by OPM.

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Home-Lighting Campaign

Announcement has been made that the home-lighting equipment sales committee of the Edison Electric Institute has developed a second home-lighting awards plan to stimulate interest in home-lighting equipment sales. Awards aggregating $1,000 are offered to utilities which in the last four months of 1941 do the best job of promoting and selling home-lighting equipment.

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Many Improvements at Monsanto Substation

Monsanto substation, located near the Cahokia plant of Union Electric of Missouri, has recently undergone changes further improving service reliability.

Two underground lines from Cahokia, one for each bus, formerly supplying the substation have been supplemented by a third line. To accommodate this line at the plant one circuit was removed and the vacated switch position partially rebuilt.

Between Cahokia and the substation 14,000 ft. of duct has been installed, with reserve space for a fourth line.

The changing of two 33-kv. overhead lines to underground required new terminal structures, extension of substation yard and dismantling of gateway towers. Temporary poles and lines were provided to obviate necessity for interruptions, and new steel structures were erected above the transformers for switches, lightning arresters and other terminal equipment.

The Kenetron system at Cahokia has been extended to the Monsanto substation, cooling fans installed on transformers and a fourth transformer has been provided for a spare.

NEWS BRIEFS

ELECTION OF John A. O'Brien and Leslie A. Baldwin as vice-presidents of the Johns-Manville Sales Corp. was announced this week. Mr. O'Brien will continue as general sales manager of the power products and industrial department and Mr. Baldwin will manage sales of industrial products to the chemical and paint, automobile and nonferrous metals industries.

LINEMEN OF THE Attleboro Steam & Electric Co. changed over 1,229 street lights in that southern Massachusetts city in one month from 600-lumen to 1,000-lumen ratings in addition to their regular duties.

W. C. MAINWARING, merchandising manager, B. C. Electric Railway Co., whose services were sought for a period by the federal authorities at Ottawa, is now achieving fame in another realm. He is one of Vancouver's outstanding amateur photographers and during the recent Canadian Pacific Exhibition, of which he is a director, he took over 300 photographs in the making of a complete pictorial record of the Exhibition. Mr. Mainwaring used over 500 flashlight bulbs in his effort.

A HANDY POCKET ESTIMATOR for figuring the monthly operating costs of electrical appliances for the home and of farm equipment has been prepared by the farm sales section of the General Electric appliance and merchandise department, Bridgeport, Conn. Designed primarily as a sales tool, the estimator is also expected to prove a handy reference for farm owners planning the extended use of electrical helpers. It gives at a glance the average operating cost of appliances or farm equipment at varying kilowatt-hour rates.

J. LEE CONOVER has been appointed branch manager of the Crosley Distributing Corp. in New York. Prior to joining the Crosley organization, Mr. Conover had been branch manager in Chicago for the Kelvinator division of the Nash-Kelvinator Corp. and before that served as West Coast regional manager of the Frigidaire Corp. He succeeds FIELDING ROBINSON, who resigned recently.

LOWVILLE, N. Y., served by the Niagara Hudson system, was visited by a near-hurricane which broke water mains and drained reservoirs. An unused pond offered a temporary supply of water and Resident Manager Howard Holt's crew was asked to rush a line down to the proposed site of a pump. In five hours 1265 ft. of pole line was completed, ready to be energized.

Krug Asks Utilities to Halt Sales Promotion

OPM power head tells Southeastern Exchange engineers how essential services may be maintained by cooperation with defense agencies — High-pressure steam and salvage practices discussed

Eliminate business promotion activities at once, was the advice given to electric utilities by J. A. Krug, OPM chief power consultant, in his first formal address to a utility industry group, the engineering and operating section of the Southeastern Electric Exchange, at its meeting last week in St. Petersburg, Fla.

Other suggestions made by Mr. Krug were to: Order only the minimum of equipment and materials necessary to meet requirements. Eliminate all frills in construction—include only the essentials for meeting service requirements. Defer major rehabilitation wherever possible; repair, rather than replace equipment; obtain maximum salvage. Use all ingenuity to develop substitutes for critical materials; in particular substitute wood for steel except where steel is essential.

These advices summed up the speaker's ideas of how the utilities should do their part in meeting scarcities of many materials and products. (See page 57 of this issue for text of Mr. Krug's address.)

Operation, Salvage

Of especial note in the two-day meetings of the engineering and operation section of the exchange were the time and attention given to steam plant operation and to salvage of materials and of equipment. The first was introduced by the comprehensive paper of K. P. Kammer, relating operating experience for three years with a new 37,500-kw., 850-lb., 900-deg. unit at New Orleans.

Comparable experience in the Twelfth Street station of the Virginia Electric & Power Co. was related by Frank Spies. R. L. Harris, Alabama Power, with experience only from May 1 with a similar unit, said that operating attendants of such machines should have special training, and agreement on this point was voiced by H. W. Sterling, Eastern Shore Public Service. George Turner, Florida Power, expressed uneasiness as to the safety of connecting together steam lines of different pressures and temperatures, as is done so frequently when new units are added to existing stations.

A significant point that rose several times was that salvage today is not simply a device for dollar economy, but even more importantly for economy of materials and equipments. This discussion was started by a pair of excellent papers by R. H. Walke and W. H. Heintzman, both Virginia Electric & Power.

Disposition to favor contract construction in overhead lines was strongly apparent in the comments on the paper by H. P. Whitehead, Georgia Power, on time-saving methods and use of machinery in transmission line erection. S. J. Spurgeon, Alabama Power, listed 19 fundamentals as "must" requirements in good design of distribution substations. B. A. Fleshman, East Tennessee Light & Power, started much discussion on fuse coordination with his paper on distribution outages. Double marking of fuses was deplored by G. M. Nelson, Eastern Shore Public Service. Revisions of the National Electrical Code included in the 1940 edition were explained and their significance to the electric utilities pointed out by J. C. Langdell of the Commonwealth & Southern Company.

An interesting series of pictures of service-entrance practices were shown and commented on by T. A. Busby, South Carolina Power. V. J. Wolfe, Atlantic Utility Service Corporation, presented an extremely common-sense view of the problems of protection of utility property. The meeting concluded with a round-table discussion of four subjects—load-curtailment measures, overhead lines near airports, short-wave line crew dispatching and proper location of lightning arresters, introduced, respectively, by C. S. Hammond, Georgia Power; P. J. Carlin, Florida Power & Light; D. H. Elliott, Appalachian Electric Power; O. R. Loomis, Georgia Power.

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Add Six Utility Men to OPM Power Unit

Six additional utility officials have joined the staff of J. A. Krug, OPM's Power Coordinator, and one member of the original staff has returned to his company post. Dr. John C. Parker, who was Krug's original priorities assistant, has returned to Consolidated Edison Co. in New York.

The new members of the staff, all specializing in priorities work, are E. W. Morehouse of the Associated Gas & Electric system trustees' staff, D. D. Chase, Detroit Edison; K. W. Miller, Commonwealth Edison, Chicago; Walker L. Cisler, Public Service Electric & Gas, Newark; O. A. Horner, General Electric, and Francis H. King, Burlington, Vt., municipal plant.

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Coulee Nears Completion

Grand Coulee Dam is 99 percent complete, according to an announcement by the Bureau of Reclamation. It will be finished two years ahead of schedule.

Southeastern Electric Exchange engineers hear Krug on priorities. Left to right, Frank Gannon, Tampa Electric; E. H. Ginn, General Electric; C. C. Curtis, Savannah Electric & Power and president of the exchange; J. A. Krug, OPM; Lewis Payne, Eastern Shore Public Service; W. E. Mitchell, Georgia Power; A. W. Higgins, Florida Power Corp.

Defense Power Supplied Despite Lengthy Drought

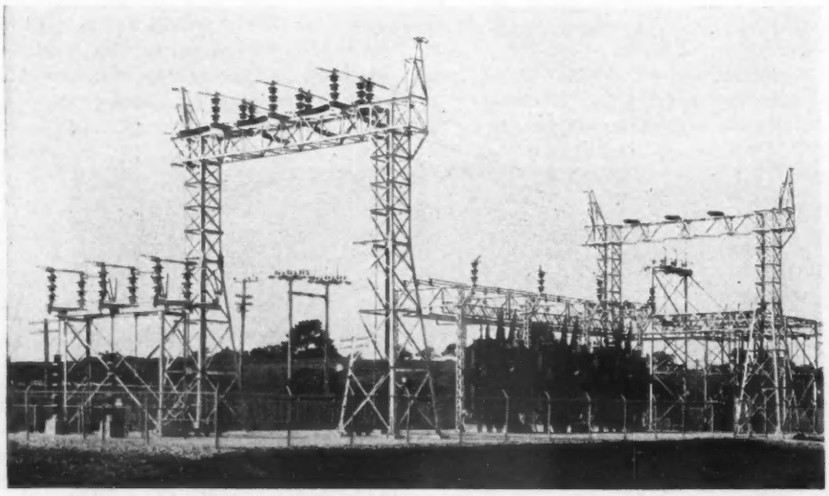
Public Service Company of New Hampshire battled drought, handled increased output effectively with aid of steam plants — Fuel situation carefully watched

Since midsummer Public Service Co. of New Hampshire has been called upon to carry steadily and rapidly increasing loads. While the effect of the national defense program on the power load of this utility began to be felt during the past winter, the full impact of this business did not appear until summer. Days of record output have been frequent and are still on the increase. In the first half year domestic customers, for some reason, did not increase their demand as rapidly as in former years, but now this trend has changed toward the former rate of gain, according to a statement by J. Brodie Smith, vice-president. At least 37 percent of the company's power customers are now engaged in producing goods either directly for the United States government or as sub-contractors for corporations or individuals having contracts connected with the defense program.

Rainfall Loss Severe

During the past three months the company has experienced one of the lowest rainfalls in its history. The bulk of its hydro-electric energy comes from the Merrimack River and its tributaries, and this has been below normal most of the time for many months. The result has been that the company has been able to obtain a smaller and smaller proportion of its power from this source and has been obliged to depend more and more upon its steam plants. Up to the present time, however, Mr. Smith declared, the company has been able to carry its increased load very comfortably and with a considerable margin of spare capacity. Of course, operating costs have been substantially affected by the increased use of fuel generation.

The fuel situation is being carefully watched. Under ordinary conditions all the company's steam plants except Kelleys Falls burn fuel oil. Fuel oil is delivered at Portsmouth, where tanks aggregating 4,580,000 gal. are located. An 85,000-bbl. tank load of oil has just been received, and from week to week supplies of coal are being shipped to Kelleys, so that, at the moment, immediate fuel needs are being met. As recently announced, an additional 10,000-kw. G.E. steam turbine unit with B&W boiler and Westinghouse condenser, have been ordered for delivery in Manchester about July, 1942, to bring the total capacity of the Manchester station (in the old Amoskeag mill yard, see ELECTRICAL WORLD, June 29, 1940) to 30,000 kw. Either fuel oil or pulverized coal will be burned, as conditions require, and the two existing oil-fired boilers at this point are to be equipped for operation by pulverized coal as well as by oil.



PORTSMOUTH SUBSTATION—30,000-kva. substation near Portsmouth, where energy from the floating power plant *Jacona* is delivered to the 66-kv. system and by a 33-kv. line to the New Hampshire Gas & Electric Co. Carrier current communication equipment has been added to the steel structure since this view was taken

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AFL Local Loses in Consolidated Strike

Members of the Brotherhood of Consolidated Edison employees may continue construction work under way at Waterside and Sherman Creek plants and New York City's local 3 of the IBEW has no jurisdiction over the work, the National Defense Mediation Board decided this week.

The decision is the aftermath of a strike called by the AF of L local last July to bring pressure on the utility to award work being done by the Brotherhood to Local 3. Members of the local in the Brooklyn Navy Yard were called out and signs on Broadway were darkened for a half-hour period.

As there is no controversy at this time involving other jobs pertaining to defense production, the board found no basis for recommending "a particular line of demarcation to govern the allocation of future work."

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Combine Priority Orders

OPM's Priorities Division has issued a compilation of all priority orders now in effect. The list includes tabulation of all three principal types of preference actions—M orders regulating distribution of materials, P orders which assist concerns needing materials, and L orders which limit production of various goods—with their effective dates and the OPM code identifications.

The compilation is released as "Release PM 1237" and copies may be obtained from the Division of Information, Office for Emergency Management, Washington.

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TVA Scope Extended

The Senate has passed the Norris bill which extends the jurisdiction of Tennessee Valley Authority to the Cumberland River and its tributaries, but the measure is headed for tough sledding in the House.

The measure goes now to the House military affairs committee, headed by Representative Andrew J. May of Kentucky, where a similar House-sponsored bill has languished for months. Mr. May has announced that hearings will be held on the proposal "after emergency legislation has been disposed of."

Defense Topics Stressed at Indiana Convention

Cost of defense, outlook for electric ranges, potential revenues from light conditioning, utility status after the emergency occupy 500 delegates at French Lick

Clifton M. Utley, nationally known radio commentator, told 500 delegates to the Indiana Electric Association at French Lick last week that before the present European war is over the United States will be spending thirty billion dollars a year on war effort; that this money will be raised by the "most ruthless" taxation this country has yet seen, and that utilities must expect, by such a program, to be caught between the pincers of rising costs and an inability to raise rates.

In spite of material shortages, 720,000 electric ranges will be sold in 1941 compared with 450,000 last year, F. H. McCormick, Frigidaire Corporation, declared. Regarding material shortages, Mr. McCormick said that nickel for heating elements was the No. 1 essential material in range production; however, sheet steel for frames is the material that will continue to limit range production. While the reduction in range production is not serious yet, the shortage of materials is becoming daily more critical, he stated, making it difficult to predict how soon production will have to be cut.

Light Conditioning

Light conditioning was described by H. H. Green of the General Electric Lamp Department, as the "wave of the present," which is potentially capable of adding $15,600,000,000 to utility revenue if all homes in this country are reached. At present, he said, 96 percent of American homes are not light conditioned. Present annual consumption from residential lighting is about 475 kw.-hr. per customer. With fluorescent lighting, but without utility promotion, this can drop to 400 kw.-hr. With light conditioning, however, it can attain 900 kw.-hr. per year through staff specialization. As a model, he said, a utility with 100,000 customers should have a lighting staff consisting of 40 home-lighting advisers, two supervisors, five dealer developers, 100 light-conditioning stores, one advertising manager and one director.

Major C. W. Leihy, editor of *Electric Light and Power*, said he believed that the industry must accept the fact that it is not going to return to the conditions of pre-regulation days. In the face of present shortages it may look forward to stabilization of rates, increasing standardization of engineering equipment and design and the growing importance of salvage of all types. Abandonment of selective load building and a trend toward mass load building after the present emergency was to be expected, he declared.

W. S. Edsall, Allis-Chalmers Manufacturing Co., traced the history of circuit-breaking inventions, leading up to the introduction of the air-break principle of arc interruption now gaining acceptance in both indoor and outdoor applications because of its rapid arc interruption and low arc loss characteristics.

G. Edward Pendray, Westinghouse Electric & Manufacturing Co., said that fluorescent lamp sales have increased from 2,500,000 lamps in 1939 to 20,000,000 in 1941, and will probably attain 31,000,000 in 1942. Incandescent lamp sales in the same time increased from 630,000,000 in 1941 to a probable 700,000,000 in 1942.

Officers of the Indiana Electric Association elected for 1942 are: President, W. Marshall Dale, president Indiana Service Corp., Fort Wayne; vice-president, Dean Mitchell, Northern Indiana Public Service Corp., Hammond, and secretary-treasurer, Roy Blossom, Indianapolis.

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PUD Suit Deferred

The consolidated case of condemnation proceedings for public utility districts against the Puget Sound Power & Light Co. in Lewis, Thurston and Cowlitz counties has been postponed in federal court in Tacoma to October 21.

AT INDIANA CONVENTION—At banquet, above, H. H. Green of General Electric Co.; C. M. Utley, guest speaker; H. T. Pritchard, president Indianapolis Power & Light, and W. Marshall Dale, president Indiana Service Corp. Indiana Service group is one of many informal gatherings

Engineers' Defense Board Organized

The establishment of the Engineers' Defense Board was announced in New York this week as a working organization of engineers and technologists from national engineering societies to deal with technical problems on shortages, substitutions, conservation, raw materials, production and reclamation.

Initial membership consists of five representatives, each appointed by the governing bodies of the A.S.C.E., A.I.M.M., A.S.M.E., A.I.E.E., S.A.E., and A.I.C.E. and the new organization will assist the various branches of government with engineering knowledge and experience on questions connected with military preparedness.

The representatives appointed for the American Institute of Electrical Engineers are H. H. Barnes, Jr., General Electric Co., executive committee representative; Philip Sporn, vice-president in charge of engineering, American Gas & Electric Service Corp.; C. A. Adams of E. G. Budd Mfg. Co.; C. B. Jolliffe of RCA; R. L. Jones of Bell Telephone Laboratories.

Officers of the Defense Board are Robert E McConnell, OPM consultant, chairman; Dr. Harry Rogers, president Brooklyn Polytechnic Institute, vice-chairman, and Dr. A. B. Parsons, secretary of A.I.M.M., secretary.

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Odlum Names Engineering Groups for Work Spread

Floyd Odlum, director of the OPM contract distribution division, has appointed a small business committee headed by Walter W. Finke of Minneapolis, president of the U. S. Junior Chamber of Commerce, and an engineering committee with George S. Armstrong of New York, president of the Association of Consulting Management Engineers, Inc., as chairman, to help in the task of speeding up subcontracting.

On the engineering committee a representative has been named for the American Institute of Mining and Metallurgical Engineers and for the American Society of Civil Engineers. In addition, this committee will include one representative each, yet to be named, for the American Institute of Electrical Engineers, the American Society of Mechanical Engineers and the American Institute of Chemical Engineers.

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Fiscal Year on Priority

An amendment to the utility repair and maintenance priority order (ELECTRICAL WORLD, Sept. 20, page 77) permits utilities with fiscal years other than the calendar year to use the last day of the fiscal year ending in 1940 as their guide in calculating maximum inventory levels of materials covered by the A-10 rating.

The original order limited inventories to "a practical working minimum" which, in no case, was to exceed the level of Dec. 31, 1940. The amendment merely permits substitution of the last day of an individual utility's fiscal year for December 31, 1940.

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Sale to P.P.D. Approved

Federal Power Commission has approved the application of the Nebraska Public Service Co., Sioux City, Iowa, to sell all of its electric transmission and distribution lines and electric substations to Consumers Public Power District of Nebraska for $318,000.

MEETINGS

Edison Electric Institute—Prime movers committee, St. Louis, Mo., October 6-7; electrical equipment committee, Hotel Cleveland, Cleveland, Ohio, October 13-14; transmission and distribution committee, Netherland-Plaza Hotel, Cincinnati, Ohio, October 20-22. Col. H. S. Bennion, managing director, 420 Lexington Av., New York, N. Y.

National Electrical Contractors Association—Fall meeting, Rice Hotel, Houston, Tex., October 6-8. L. W. Davis, general manager, 420 Lexington Avenue, New York, N. Y.

National Safety Council—National Safety Congress and Exposition, Stevens Hotel, Chicago, Ill., October 6-10. W. H. Cameron, managing director, 20 North Wacker Drive, Chicago.

American Institute of Electrical Engineers—South West district, Coronado Hotel, St. Louis, Mo., October 8-10; Southern district, New Orleans, La., December 3-5; winter convention, New York, N. Y., January 26-30. H. H. Henline, national secretary, 29 West 39th St., New York, N. Y.

Commercial Electric Cooking Council—Fifth annual conference, Hotel Knickerbocker, Chicago, Ill., October 9.

Wisconsin Utilities Association—Electric section, Hotel Schroeder, Milwaukee, October 13-14. A. F. Herwig, executive secretary, Room 502, Brunder Bldg., 135 West Wells St., Milwaukee, Wis.

American Society of Mechanical Engineers—Fall meeting, Louisville, Ky., October 13-15, C. E. Davies, national secretary, 29 West 39th St., New York, N. Y.

National Electrical Wholesalers Association—Semi-annual convention, Hotel Statler, Detroit, Mich., October 14-17. E. Donald Tolles, managing director, 165 Broadway, New York, N. Y.

American Welding Society—Annual meeting in conjunction with National Metal Exposition, Bellevue Stratford Hotel, Philadelphia, Pa., October 19-24. Miss M. Kelly, secretary, 29 West 39th St., New York, N. Y.

Oklahoma Utilities Association—Eastern district conference, Muskogee, Okla., October 23; western district conference, Norman, Okla., October 24. Kate A. Niblack, secretary, 625-26 Biltmore Hotel, Oklahoma City, Okla.

National Electrical Manufacturers Association—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., October 27-31. W. J. Donald, managing director, 155 East 44th St., New York, N. Y.

National Research Council—Conference on Electrical Insulation, annual meeting, Williamsburg, Va., October 30-November 1. Thorstein Larsen, secretary, Consolidated Edison Co. of New York, 55 Johnson Street, Brooklyn, N. Y.

Southeastern Electric Exchange—Fall sales conference, Henry Grady Hotel, Atlanta, Ga., October 30-November 1. J. W. Talley, executive secretary, 303 Haas-Howell Building, Atlanta, Ga.

Frisco Faces Ninth Public Power Effort

Plan 9, designed for putting San Francisco into the municipal power business, will appear on the November 4 ballot of that city as Charter Amendment No. 1. Similar measures have been defeated eight times. As agreed to in stipulations advanced by Secretary Ickes, no controversial measures will be on the same ballot.

Conducting the campaign in favor of the bonds is a Citizens Power Committee that has the backing of the city administration (another stipulation of Secretary Ickes), the San Francisco Labor Council and the Building Trades Council. Opposition is headed by the Committee to Defeat the Power Bonds and Amend the Raker Act, which has the support of many civic and business groups.

Plan 9 proposes the issuance of $66,500,000 of revenue bonds to be used for purchase of parts of the Pacific Gas & Electric distribution system, for enlargement of power generation and transmission facilities and for contingencies. Analyses of the capital assignment indicate that the various undertakings set forth will probably cost $90,000,000 instead of the amount to be authorized. For instance, $2,542,000 is set aside for purchase of the 44,000-kw. Station "P" steam plant and an additional $2,673,000 for a 48,000-kw. addition, an average of $56.70 per kw., as against the going price for steam additions of approximately $100 per kw.

•

Kellogg to Address T. & D. Committee in Cincinnati

At the fall meeting of the transmission and distribution committee of the Edison Electric Institute, to be held at Cincinnati, Ohio, October 20-22, Charles W. Kellogg, president of the Institute, will make an address on the National Power Situation at the luncheon meeting to be held on October 21.

Program for the general session was published in the September 27 issue of ELECTRICAL WORLD, page 10.

•

Repay REA in Advance

Fifty-five REA systems in 20 states repaid $291,279 to the federal government in July and August before it was due, Harry Slattery, Administrator of Rural Electrification, has announced. These prepayments are in addition to the regular payments of interest and amortization payable by the REA systems in accordance with their loan contracts.

Output Continues Almost Unchanged

Edison Electric Institute reports that the amount of electrical energy distributed by the electric light and power industry for the week ended September 27 was 3,233,278,000 kw.-hr., just about the same output as in the corresponding week a year ago.

Last year an increase of about 10 percent was experienced in weekly output.

This year, during the week of September 27, generally good weather has prevailed throughout the country. This is probably one of the reasons why output is approximately unchanged compared to output for the preceding week of September 20.

Moreover, it is noted that output in each of the several geographic sections is likewise approximately unchanged. This situation, it is expected, will probably be altered in the next week or two.

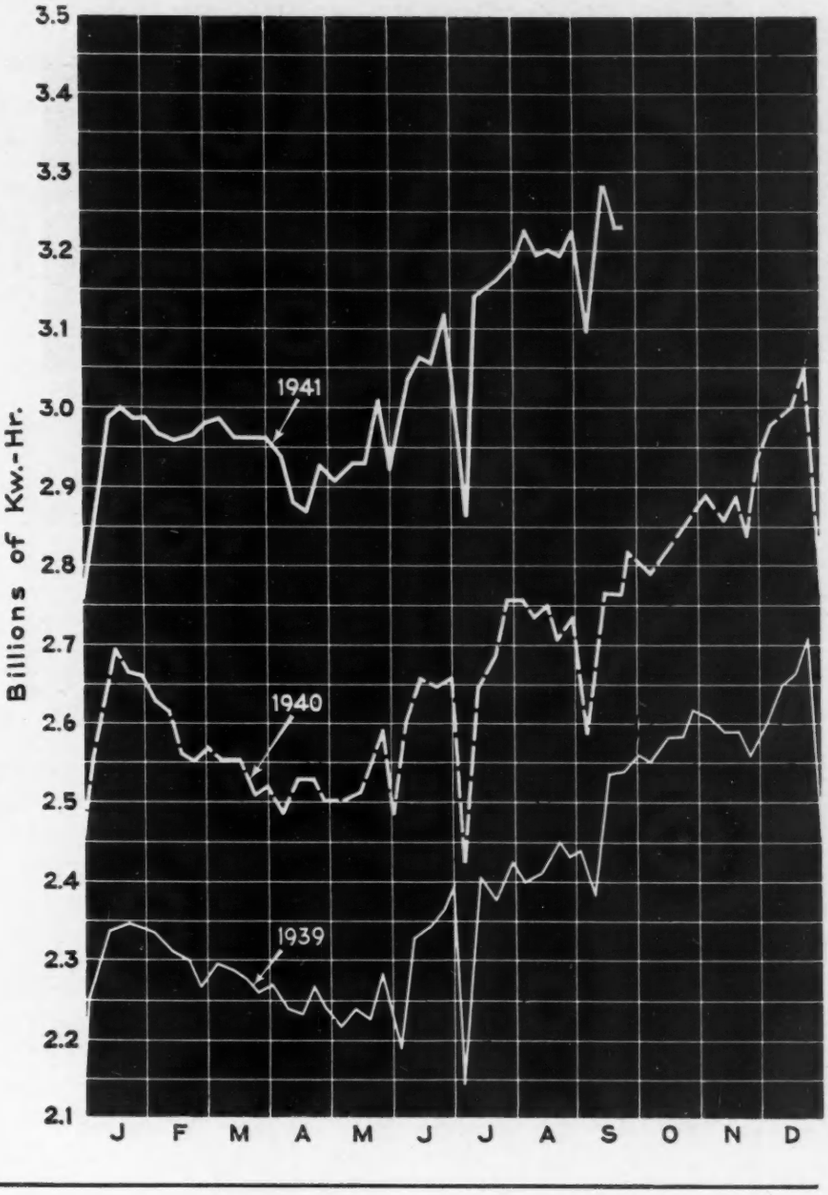
Weekly Output, Millions Kw.-Hr.

1941		1940		1939	
Sept. 27	3,233	Sept 28	2,816	Sept. 30	2,558
Sept. 20	3,232	Sept. 21	2,769	Sept. 23	2,538
Sept. 13	3,281	Sept. 14	2,773	Sept. 16	2,532
Sept. 6	3,096	Sept. 7	2,592	Sept. 9	2,376
Aug. 30	3,224	Aug. 31	2,736	Sept. 2	2,376
Aug. 23	3,193	Aug. 24	2,714	Aug. 26	2,434

Percent Change from Previous Year

	Week Ending		
	Sept. 27	Sept. 20	Sept. 13
New England	+18.9	+18.4	+19.6
Mid-Atlantic	+10.8	+14.2	+16.1
Central Industrial	+17.4	+18.2	+19.6
West Central	+13.1	+13.6	+13.8
Southern States	+16.8	+22.6	+27.1
Rocky Mountain	+17.1	+10.3	+ 7.4
Pacific Coast	*+ 9.6	*+10.7	*+10.8
Total United States	+14.8	+16.7	+17.7

* Percentage should be higher — data under revision.



OPM Estimates 1942 Copper Shortages

OPM officially estimates the 1942 shortage in copper at 770,000 tons. This is based upon an assumed unrestricted civilian consumption, plus military requirements.

The supply and demand tabulation looks this way:

Domestic production, 1,100,000 tons; Latin American imports, 500,000; other imports 100,000; secondary copper, 100,000—total 1,800,000 tons.

Military requirements, 1,000,000 tons; essential civilian, 400,000; other civilian, 1,170,000—total 2,570,000 tons.

No official definition is given for the distinction between "essential civilian" and "other civilian." It is known that copper for utility maintenance and defense expansion is included in the first category, with copper for appliances and non-defense home construction in the second.

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Acquires City System

Toledo Edison Co. has concluded negotiations for acquiring the Walbridge, Ohio, electric system with 300 customers. The Edison company turned over to the Walbridge Board of Control a check for $15,250 to conclude the transaction and signed new contracts for street lighting and customer use.

•

Will Reconstruct Lines

Wisconsin-Michigan Power Co. has announced plans for a $32,000 power line reconstruction job in the city of Menasha, Wis., to be started this fall. The project will include rebuilding of the 33,000-volt high-tension line along Third Street on higher poles with new hardware and new type insulators intended to cut down radio interference.

•

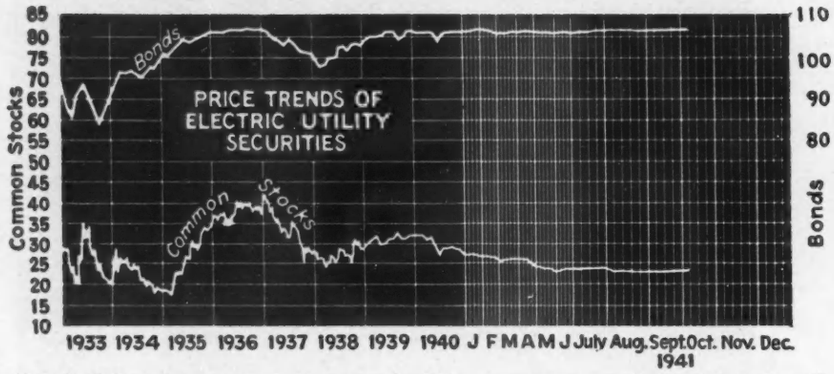
New Service Regulations Proposed in Maryland

The Public Service Commission of Maryland last week issued to Maryland utility companies a new set of regulations to govern service supplies by electric utilities.

Hearings are scheduled to be held in the commission's hearing rooms in Baltimore November 5 to discuss the proposed regulations.

Records and reports, meters and metering and plant operation and maintenance are topics embraced by the 42 rules making up the regulations.

Utility Stocks Dip; Bonds Rise Slightly


PRICE TRENDS OF ELECTRIC UTILITY SECURITIES
Bonds
Common Stocks
Common Stocks
Bonds
85 80 75 70 65 60 55 50 45 40 35 30 25 20 15 10
110 100 90 80
1933 1934 1935 1936 1937 1938 1939 1940 J F M A M J July Aug. Sept. Oct. Nov. Dec.
1941

Electric light and power securities moved within a narrow range during the past week. "Electrical World" stock index dipped from 23.8 last week to 23.4; last year, 28.9. The bond index moved slightly upward to 105.8, from 105.7 the preceding week

Plans to Sell Puget Sound and Key West

Donald C. Barnes, president Engineers Public Service Co., told stockholders in a letter last week that the company intends to comply with the Securities and Exchange Commission order to dispose of its interests in Puget Sound Power & Light Co. and in Key West Electric Co.

In disclosing these plans, however, Mr. Barnes made reference to the commission's statements that if general conditions were unfavorable to disposal of the properties within the year additional time would be granted so that undue losses would be avoided.

Taxes paid by Engineers and its subsidiaries in 1942 will be double those paid in 1941, Mr. Barnes stated. The system's total federal tax bill under the new revenue act will be more than $2,600,000 above what would have been paid on this year's increased earnings under the 1940 tax rate.

Introduction of evidence in present SEC proceedings is coming to a close, Mr. Barnes said, and consideration of evidence and filing of briefs will precede any final decisions as to the retention of properties under the holding company act.

•

P. G. & E. Appeals from SEC Jurisdiction Rule

A stay of execution pending appeal of the recent SEC ruling that Pacific Gas & Electric Co. is subject to the provisions of the holding company act has been granted by the U. S. Circuit Court of Appeals in San Francisco. The SEC order was based upon the fact that North American Co., through ownership of 17.71 percent of P. G. & E. voting stock, exercises a negative control and potentially an affirmative influence over the company's policies.

The petition for the stay of execution and appeal held that P. G. & E. neither is controlled by a holding company nor is it a holding company itself, and hence is outside the jurisdiction of the act. It contended that the SEC ignored the findings of its trial examiner, whose report concluded that P. G. & E. was not a North American subsidiary.

•

Two Utilities File Refunding Plans

Central Illinois Public Service Co. has filed an application covering $38,000,000 of first-mortgage bonds, series A, due on October 1, 1971, and $9,000,000 of unsecured notes due on April 1, 1942, to October 1, 1951. Proceeds are to be for redemption of $38,000,000 of 3¾ percent first-mortgage bonds, series A, due on December 1, 1968, and for redemption or payment at maturity of $9,000,000 of 3½ and 4 percent serial debentures due on December 1, 1941 to 1948.

Philadelphia Electric Co. has filed an application in connection with proposed issuance and sale of $20,000,000 of 2¾ percent first and refunding mortgage bonds due on December 1, 1971. Net proceeds will be used for payment of $20,000,000 of 1½ percent promissory notes which are to mature on December 3 next. The balance of the proceeds, if any, will be added to general cash funds.

•

U.G.I. Petition Denied

Securities and Exchange Commission has denied the application of the United Gas Improvement Co. and its subsidiaries for rehearing of the commission's order that the parent company divest itself of several of its subsidiaries under Section 11 (b) (1) of the Public Utilities Holding Company Act.

•

Polhemus Stresses Residential Revenue

Despite a rate cut of $1,750,000 since the beginning of last year, Portland General Electric expects a net income of $1,500,000 this year due to residential sales promotion, according to James H. Polhemus, president of the company.

"We have been looking toward the long future," Mr. Polhemus declared. "When this emergency is over the backbone of our revenues will be residential consumption. That is why we have consistently been plugging away at the promotion of range, and especially water heater, installations. With the pinch of priorities beginning to be felt, we can now see the wisdom of aggressively promoting appliances during the years when they were available."

In the first eight months of this year the company connected 6,000 ranges and 2,800 water heaters, an increase of 39 percent over 1940 sales. In the Portland metropolitan area electric ranges went into 85 percent and electric water heaters into 47 percent of all new homes.

•

To Acquire Properties

The District Commissioners of the Kitsap PUD, Bremerton, Wash., have adopted a resolution to take steps toward acquisition of the Kitsap County holdings of Puget Sound Power & Light Co. by condemnation. They authorized a $2,000,000 revenue bond issue to purchase the utility's plant, transmission lines and business.

Utility Reports

	Net Income 1941	1940
*American Power & Light and subs.	$10,731,139	$12,348,756
†Associated Electric and subs.	1,822,891	2,486,955
‡Blackstone Valley Gas & Elec.	1,082,651	1,094,997
‡Central Maine Power	2,239,673	2,182,045
‡Commonwealth & Southern and subs.	14,648,268	13,639,047
‡Conn. Light & Power	3,967,007	4,036,762
‡Houston Ltg. & Pwr.	3,089,794	2,882,117
‡Montana Power and subs.	3,584,225	4,168,249
‡Nebraska Power	1,719,414	1,658,768
†Standard Gas & Elec. and subs	4,513,310	4,079,786
†Toledo Edison	2,486,699	2,758,843
‡Texas Power & Light	1,985,920	2,051,024

*Twelve months ended July 30.
†Twelve months ended June 30.
‡Twelve months ended August 31.

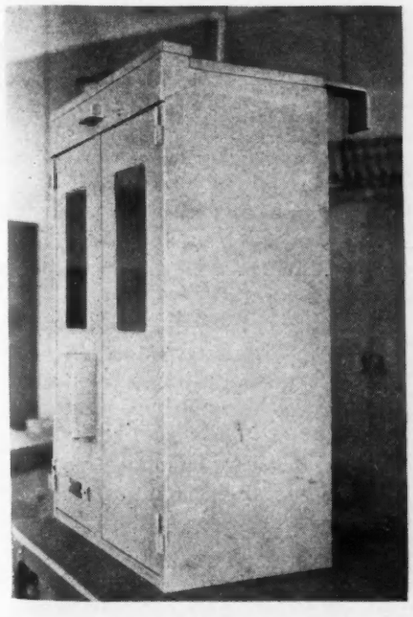
OPERATING PRACTICES

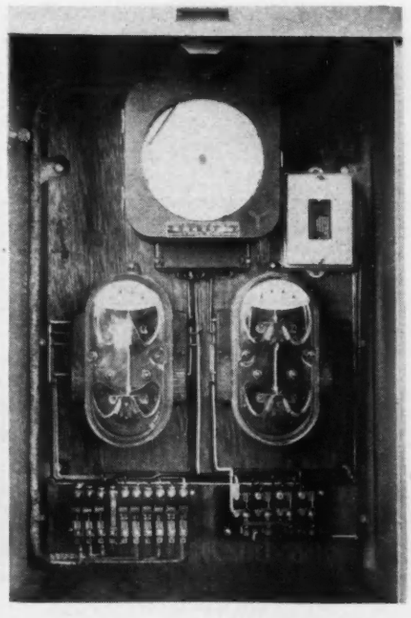
Inclosure for Polyphase Metering

By M. F. SMALLEY
Superintendent of Service and Meters
Ohio Power Company, Canton

Standardized pattern of metal box inclosure for polyphase metering installations is used in small substations and for pole installations of either primary or secondary metering. The cabinet is 25 x 13 x 36 in. in width, depth and height and accommodates all combinations of side-connected and bottom-connected watt-hour meters as well as indicating and graphic demand meters. The meter panel is removable and can be wired in the shop while the construction crew installs the inclosure on the job.

Hub is provided at top for raintight connection for control cable or conduit. Knockouts are provided at sides and bottom. Ground stud is provided to ground the inclosure.





POLYPHASE metering inclosure has versatile application. Double doors preferable to single door when inclosure is installed in narrow space. Large windows allow meters to be read with ease

•

Simplifies Regulator Setting

Procedure for setting the contact-making voltmeter of regulators on the Nebraska Power Company system has been considerably speeded by use of a test board that can be quickly plugged into a "PK" test block provided at each regulator location. Circuit is shown in the accompanying diagram.

Procedure in making the adjustment is as follows: Remove the cover of the PK test block and insert test plug. This plug short circuits the current transformer and connects a 120/6-volt transformer and series rheostat across the potential circuit so that voltage impressed on the contact-making voltmeter coil can be varied from 114 (field rheostat resistance in) to 126 volts.

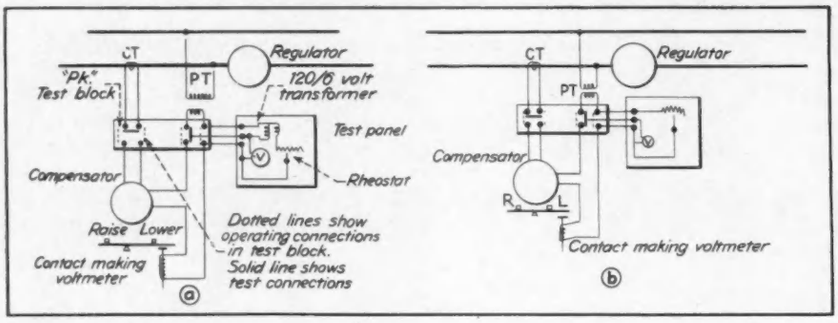
With voltage adjusted to 120 volts, armature of the contact-making voltmeter is balanced. Next by adjusting the rheostat, raise voltage on contact-making voltmeter coil to 120¾ volts and set the buck contact to "make," which will start the regulator to buck voltage. Immediately set the buck-holding coil to run the regulator down to 119¼ volts. Run the regulator back to 120-volt position and adjust rheostat to impress 119½ volts on the contact-making voltmeter and adjust boost contact to "make." With this done, adjust "boost"-holding coil to run regulator to 120½ volts. Adjustment is then complete.

With this adjustment, when voltage drops to 119¼ on the system, the regulator boosts it to 120½. When system voltage goes to 120¾ the regulator bucks it to 119½. The quarter-volt bracket keeps the regulator from hunting.

No-Load Adjustment

A modification of the idea is used in setting the no-load adjustment so no-load voltage will be 120 at all times. To do this the 120/6-volt potential transformer on the test panel is cut out, leaving only the resistor in series with the coil of the contact-making voltmeter, as shown in circuit "b." The rheostat should be connected so that increased resistance will reduce voltage on the contact-making voltmeter coil. Zero resistance position of rheostat will then represent no load.

To make adjustment, run the regu-



PLUG-IN TEST PANEL speeds setting of regulator contact-making voltmeter and no-load adjustment. (a) Connections for setting contact voltmeter, (b) connections for no-load adjustment

lator off no-load position by cutting in resistance with the rheostat. Next, snap the rheostat back to zero position, permitting regulator to return to no-load position. Then adjust the no-load spring to make this position 120 volts.

Advantage of this procedure is that the regulator is always traveling in the same direction to the no-load position, making for uniform settings by different individuals.

•

Simple Phasing Kit for Cable Splicers

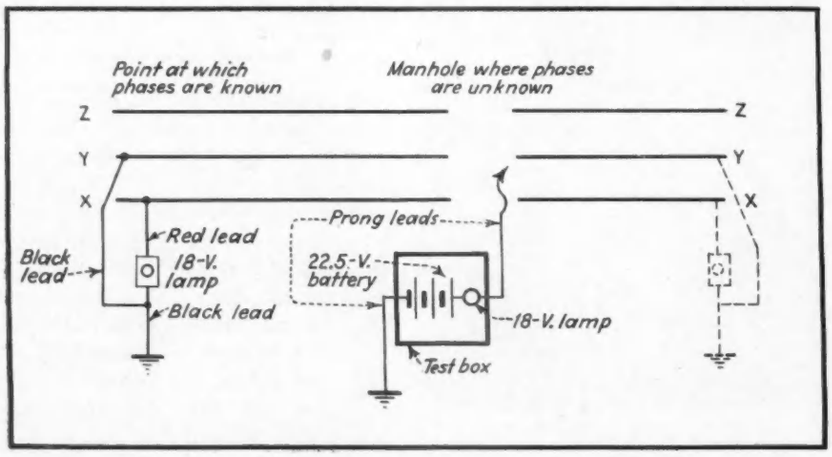
For cutovers, replacements and other types of cable phasing work the Detroit Edison Company has worked out a compact, inexpensive phasing kit for cable splicers which has simplified phasing operations considerably.

This phasing kit is in two parts. The part used at the manhole, where phasing work is to be done, is a 6 x 8-in. No. 16 gage sheet metal box housing a 22.5-volt, 15-cell dry battery and fitted with an 18-volt type T-4 candelabra base lamp in an indicating lamp receptacle. The lamp and battery are connected in series and short detachable prong leads are provided for making test connections, as will be explained. Another part of the set is a type T-4, 18-volt test lamp with three leads (two black and one red) connected to its socket receptacle. The two black leads are connected to a common lamp terminal, the red lead to the other terminal.

In use the kit is connected as shown in the diagram. The test lamp is taken to some adjacent point (such as a cable pole) where phase relationships are known. Here one of the lamp's two black leads is connected to ground, the other to the "Y" phase terminal. The red lead is attached to "X" phase terminal. Returning to the manhole, where phasing is to be determined, the splicer plugs the two prong leads into the metal box and attaches one to a good ground. With the other lead he contacts the copper conductors to "pick up" phases. As each conductor is touched in turn, "X" phase will give half light on the indicating lamp in the box, "Y" will give full light and "Z" phase will give no light.

After marking the conductors properly the splicer proceeds to pick up phases from the other direction in a similar manner. When phases have been obtained from both directions the splicer can proceed to complete his joint.

Any apparatus (test lamp for example) installed on a cable pole, or elsewhere, during the test must be removed by the splicer before he calls in to clear the line. To help him remember, it has been found helpful to fasten a red tag to the lock of the splicers' tool cart or steering wheel of the truck so it will have to be removed before the cart can be locked or the truck driven away.



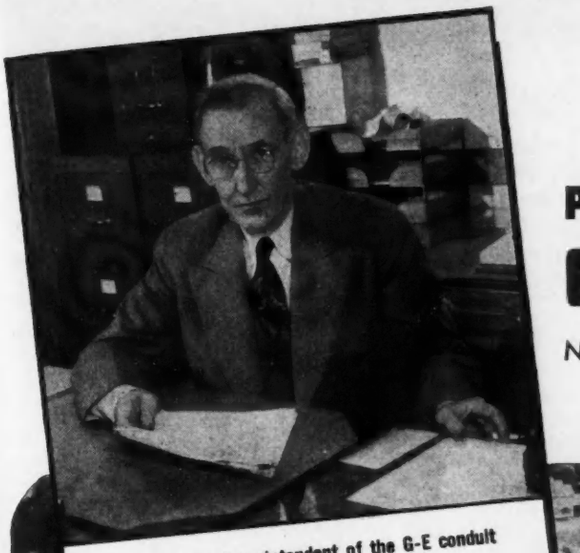
SYSTEM of connects for the dim-bright phasing kit used by Detroit cable splicers. Phase "Y" is identified when lights are bright, "X" when dim, "Z" when no light shows

•

"Crow's-Nest" for Small-Tree Trimming

Small trees, always a potential source of line trouble, are difficult to climb, but present no problem for trimming where a crow's-nest is employed. According to Fred Hardesty of the Northwestern Electric Company, Portland, Ore., the equipment has proved adaptable to other tasks also in the Vancouver and Camas, Wash., districts, including mounting of street-lighting fixtures of both bracket and suspension types.

The equipment is a standard Murray crow's-nest consisting of two 13-ft. ladder sections with collapsible platform, mounting frame, pivot bolt, and supports mounted at approximately the center of the bed on a

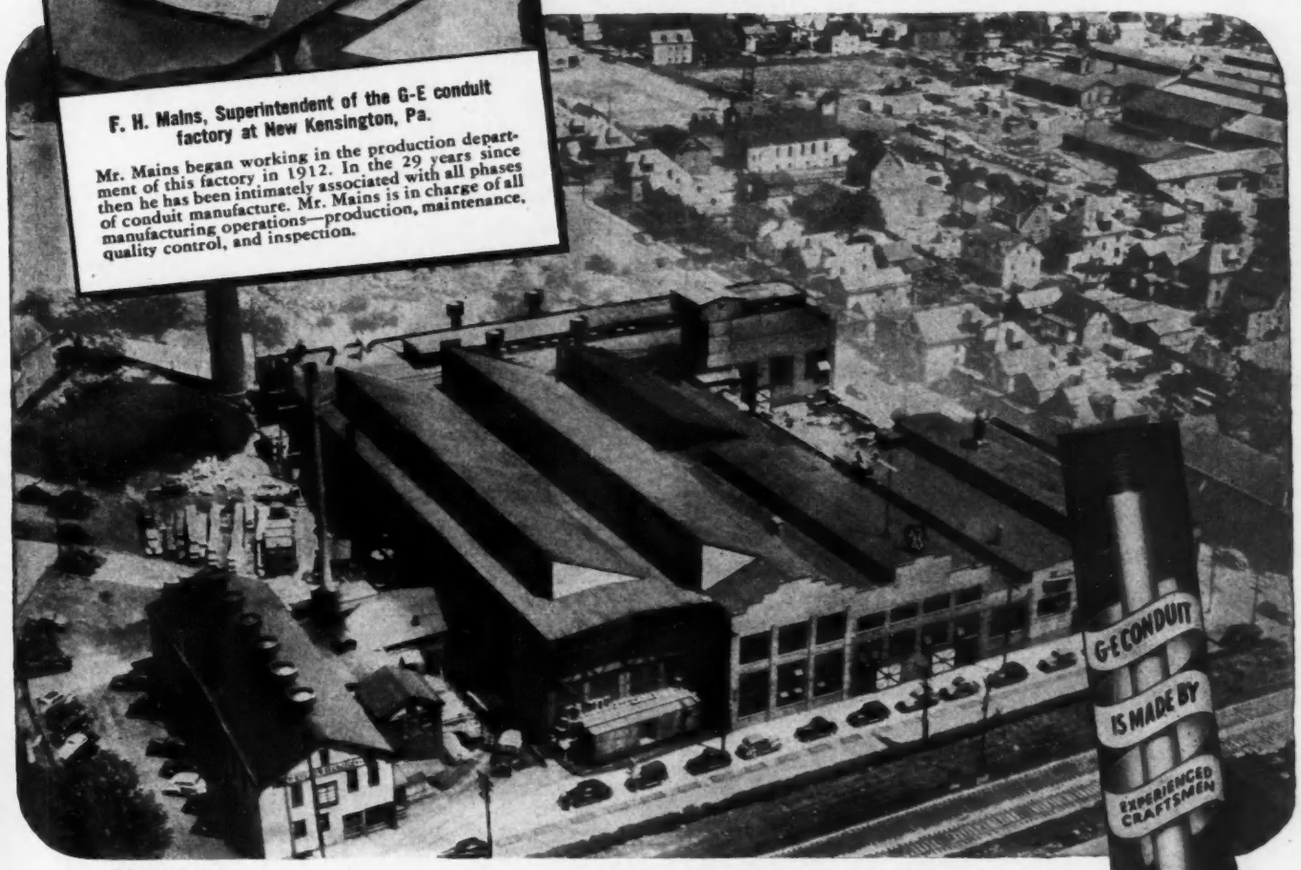


F. H. Mains, Superintendent of the G-E conduit factory at New Kensington, Pa.

Mr. Mains began working in the production department of this factory in 1912. In the 29 years since then he has been intimately associated with all phases of conduit manufacture. Mr. Mains is in charge of all manufacturing operations—production, maintenance, quality control, and inspection.

Pride of Workmanship Marks G-E RIGID CONDUIT

No. 1 of a Series—Men and Processes Behind G-E Conduit



Fairchild Aerial Surveys, Inc.

G-E Conduit Factory at New Kensington, Pa.

WHEN you look at a piece of G-E White or G-E Black you can tell that it was made by skilled craftsmen, proud of their work. The uniform high quality of this conduit is concrete evidence of careful workmanship. Three factors help the men who make G-E Conduit: they have had long experience, they use only the finest of raw materials and they work in a factory with the best of modern equipment.

Careful workmanship starts with the painstaking selection of steel tubing which must meet detailed specifications. All processes in the manufacture of G-E Conduit are handled with equal care by skilled men—the pickling, the hot-dip galvanizing of G-E White and the enamelling of G-E Black, the straightening, the threading and the shipping. Tests are made constantly. Inspections are made daily of equipment, processes and materials.

For further information about G-E Conduit see the nearest General Electric Merchandise Distributor or write to Section C-190, General Electric Company, Appliance and Merchandise Department, Bridgeport, Connecticut.

GENERAL ELECTRIC

standard Chevrolet 1½-ton, stake-body truck. Weight of the crow's-nest installed is approximately 800 lb.; cost, approximately $450.

•

Effect of Ground Rods in Multiple

By J. R. EATON *
Purdue University, Lafayette, Ind.

The conductance of a group of rods in parallel at close spacing is considerably less than that of the same number of rods at a wide spacing. Consequently, if an attempt is made to obtain a low-resistance earth connection by the use of many ground rods, it is imperative that these rods be far enough apart that their current paths will not greatly overlap.

An accompanying curve shows a comparison between the conductance of 10-ft. rods in groups and a deep-driven rod having the same total length. From this curve it may be observed that the conductance of a group of ten 10-ft. rods spaced 5 ft. apart is equivalent to 3.3 times the conductance of a single ground rod 10 ft. in length. This same conductance is obtained by 40 ft. of rod if the entire footage is driven straight down to a total depth of 40 ft. Approximately the same results would be obtained with four 10-ft. rods spaced 20 ft. apart. This curve shows quite definitely that equal footage in a deep-driven rod is far superior to a number of 10-ft. rods unless the spacing can be of the order of 20 ft. between individual 10-ft. rods.

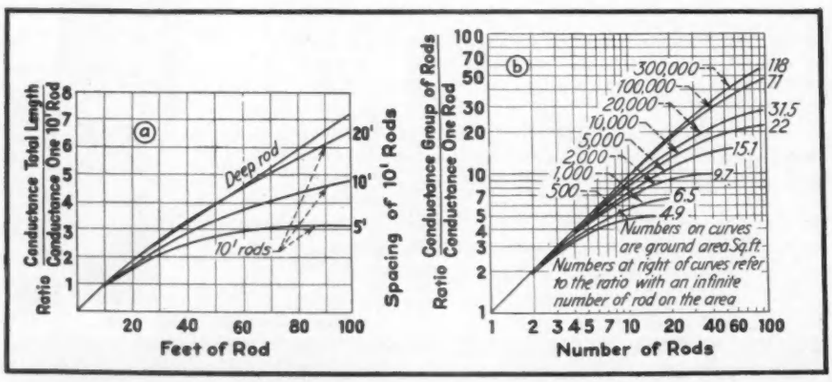
*Consultant for James G. Biddle Co.

In addition to the advantage in conductance offered by the deep-driven rod, there is the further advantage that such a rod may reach to permanent moisture level, at which the earth resistivity will be considerably lower than near the surface. Moreover, variations in resistance due to changes in temperature and moisture content are considerably less for the deep rod.

The relation between the conductance of a group of rods spread over a given area to the conductance of a single rod is shown on another accompanying curve. From this figure it will be seen that if a group of rods is to be confined to an area of 500 sq. ft. the maximum conductance obtainable with an unlimited number of rods is only 4.9 times that for a single rod. As is indicated by the curve, there would be little point in placing in this area more than, say, ten rods, inasmuch as ten rods equally spaced would result in a conductance 4.6 times that of a single rod as compared with 4.9 for the conductance of an infinite number of rods.

If it were desired to have the conductance of the group of rods greater than ten times that of a single rod, it may be seen from the figure that these rods must be distributed over an area in excess of 2,000 sq. ft. If confined to an area of 2,000 sq. ft. the maximum conductance that could be obtained with an infinite number of rods would be 9.7 times that of a single rod. These curves indicate a closely knit relationship between ground area and the maximum conductance of a group of rods of unlimited number.

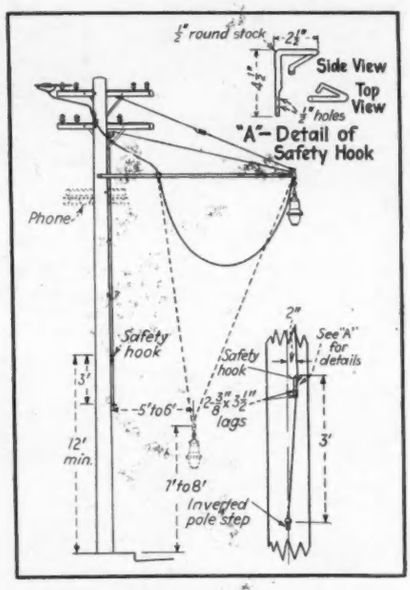
[ED. NOTE—This is the sixth in a series of articles on various phases of grounding.]



CONDUCTANCE of a single deep-driven rod is higher than that of the same length of rod material driven in 10-ft. lengths, unless the spacing between the separate rods is considerable (a). Relation between conductance of a single deep-driven rod and a group of 10-ft. rods in a given area is shown in (b).

Street-Light Lock Foils Pranksters

Source of annoyance to Public Service Company of Colorado employees was the regular post-Halloween task of pulling up street lights lowered to within a few feet of the ground by pranksters. Until the company devised a simple "lock" to foil



"EYE FIXTURE" foils Halloween pranksters bent on lowering street lights

the youngsters they had to pull up 50 to 75 street lights every November 1, scattered from one end of Denver to the other.

Street lamps in the city are suspended by a cable and pulley arrangement, as shown in the sketch. The cable, with a ring in the end to hold the lamp at proper height, is slipped over pole step 9 ft. from the ground. By placing an open safety hook, through which the ring on the end of the suspension cord will not pass, 3 ft. above the pole step, the feat of lowering the street lamp became sufficiently difficult to foil those not in the "know."

Maintenance men bent on lowering the lamps disengage the ring from the pole step and swing the suspension cord sideways sufficiently to disengage the rope from the special safety hook. This can be done from the ground with a hook stick.

By coincidence this solution was worked out by the man whose job it was to put the lamps up after Halloween. About 4,000 safety hooks are in use in Denver.

WE RENEW OUR PLEDGE

Two years ago, at the beginning of the present war with its uncertainties and threats to the future of all industry, this Company publicly pledged itself not to increase its selling prices.

On this, the second anniversary, we again publicly renew that pledge.

During the last two years we have not only kept the pledge previously made, but *we have actually reduced our selling prices by more than 6%* because of more efficient operation made possible by the marvelous cooperation and ability of our organization. This was accomplished in the face of rising labor and material costs, both of which have been increased by considerable amounts.

It is our belief that the only hope for the continuance of the present industrial system now threatened from within and without is in its ability to give more and more to the consumer for less and less of his dollar. This is the strength of American individual initiative. This is the hope of our country's future. If American industry can accomplish this universally, we need not fear dictators either at home or abroad.

THE LINCOLN ELECTRIC COMPANY

Cleveland, Ohio
October 2, 1941

J. F. Lincoln
President

INDUSTRIAL ENGINEERING

Compact Door Controls in Telechron Plant

Advantages of centralized control of motor drives are illustrated in the new storehouse building of the Warren Telechron Company, Ashland, Mass., where a covered area for truck deliveries is provided with three Kinnear rolling doors to enable work to be carried on without exposure to weather conditions. A 23 x 14-ft. outside door driven by a 3-hp. motor affords entry into the covered area from the driveway, and two 8 x 10-ft. doors, each driven by a $\frac{1}{3}$-hp. motor, furnish access to the first floor of the building from trucks in the foregoing area. Material handling is thus possible under favorable conditions, enabling the manufacturer to bring trucks up to the unloading points without exposing the interior of the building to excess cold, and carrying on the process while the outer air is cut off from the interior.

Controls of the motors center on a wall panel between the two inside doors, all wiring being in conduit and with three push-button start and stop blocks for the motors mounted at the bottom of the group. Above are mounted switch and contactor boxes for the motor circuits, and the conduit connections terminate in a metal junction box at the top of the panel. Most of the circuits are carried in $\frac{3}{4}$-in. conduit, with the exception of the main power supply, which is in 1-in. pipe. A wooden base panel carries the switch and contactor boxes, and a novel feature is a 10 x 16-in. wired glass transparent window in the recess just above the push-button group, enabling the operator to see the state of affairs in the inclosed area and the operation of the outer door. Trumbull switch boxes and 208-volt motors are used, with General Electric control equipment.

In this same building, which is three stories high and 65,000 sq.ft. in floor area, a 4,000-lb. electric freight elevator of McLaughlin make, running 75 ft. per minute, is in use, driven by a 15-hp., 230-volt d.c. motor, for which energy is obtained from a motor-generator set. The landing doors on each floor are operated by two motors each, with automatic control and mounting in recesses in the brick wall, which insure maximum accessibility. Metal covers will be applied over these openings to eliminate fire hazard. This mounting arrangement provides for equalization of the load and enables a motor to be quickly replaced when conditions require it, as the conduit wiring can be readily disconnected and no useful space is occupied on the premises.

CENTRALIZED switch assembly facilitates operation and maintenance (left). Recessed mounting of motors provides superior accessibility

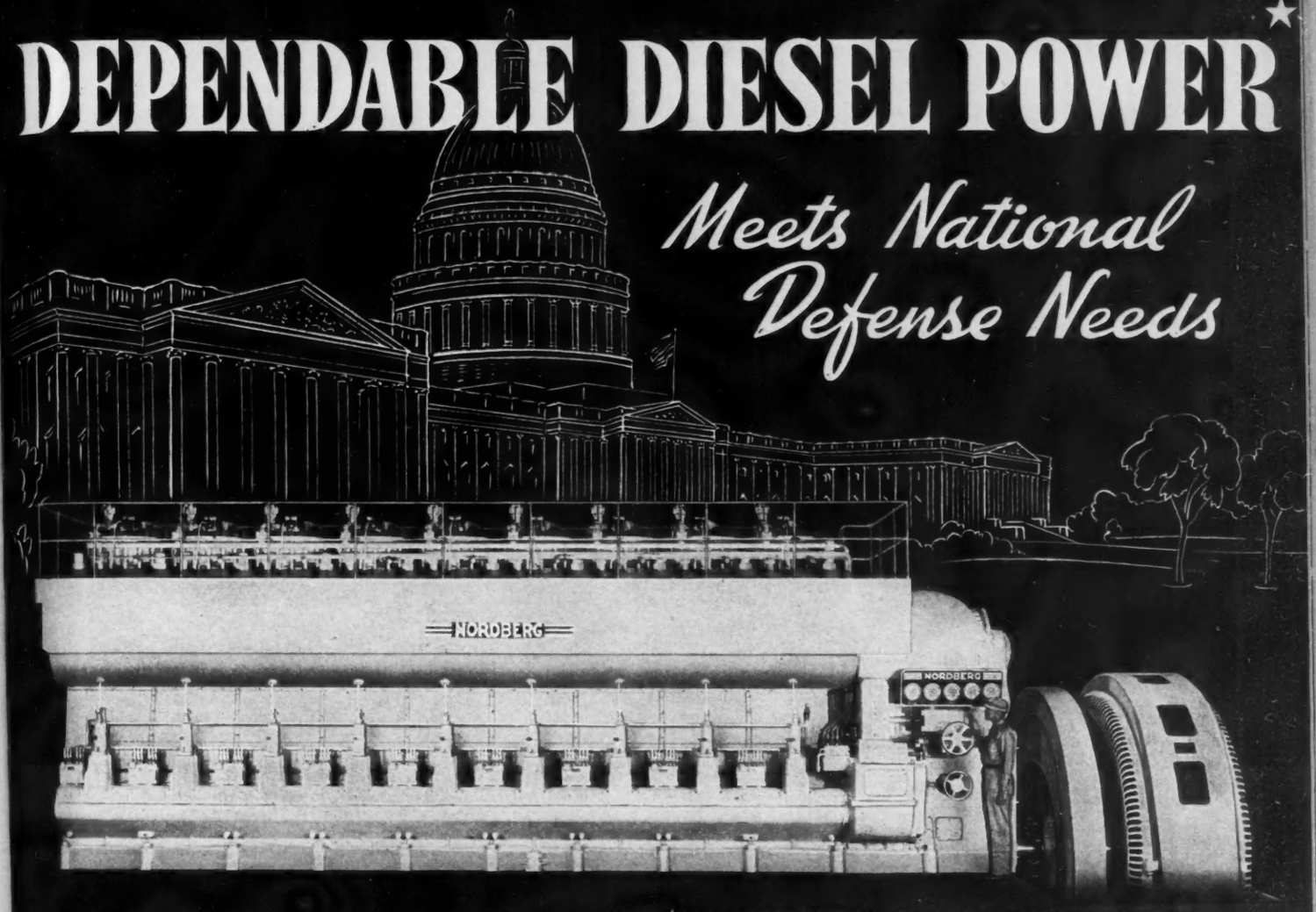
Cut Cost in Two With Infra-Red

Cost of applying a wrinkle finish to drill presses and tapping machines at the Chicago plant of R. G. Haskins Company has been halved and the rate of finishing increased from 15 to 24 machines in eight hours since this machine tool manufacturer started radiant heat for drying the gray synthetic enamel used.

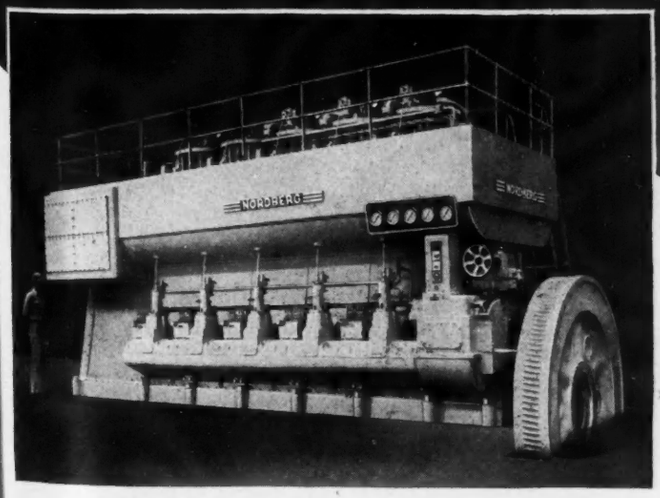
A unique cylindrical lamp bank, mounted on casters and split lengthwise, incloses the machine casting during the baking operation. The

DEPENDABLE DIESEL POWER ★

Meets National Defense Needs



★ Four 3600 BHP Nordberg Diesel Engines built for a Government power plant serving defense. This station is one of the larger Diesel installations in the country.



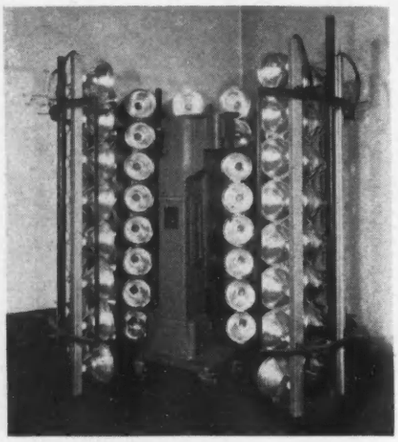
★ Three Nordberg Diesel Engines, one 2000 BHP and two 2400 BHP of the above type supply power for one of the important outlying air bases.

In these days of emergency it is most essential that an adequate and reliable supply of power be available. Nordberg Diesel Engines with their long record of dependable and economical performance are especially suited for power generation. That Nordberg Diesels have been selected for important defense work is evidence of the confidence won by these engines through many years of faithful, trouble-free service and efficient performance.

NORDBERG MFG. CO., MILWAUKEE WISCONSIN

NORDBERG DIESEL ENGINES

rack houses 80 250-watt infra-red lamps in 8-in. Alzak reflectors and has an inside diameter of 35 in. measured between reflector rims. Lamps are arranged in eight rings of ten lamps, one above the other and spaced equally around the inside circumfer-



SPLIT cylindrical bank of 80 infra-red lamps finishes 24 castings in eight hours

ence of a simple angle-iron frame. Each of the eight rings of lamps is individually switched so that the surfaces of the casting further from the lamps can be baked longer than others.

Finished castings are first given a gray priming coat that air dries in 30 minutes. Over this the gray synthetic enamel for the wrinkle finish is sprayed (time to spray is four to five min.). About 20 minutes under the lamps is required to complete the bake. Of this time about 15–18 minutes is required to bring the surface up to temperature (about 250 deg. F.). Once up to temperature, the wrinkle finish appears in the last three to four minutes under the lamps. Distance between lamps and work varies from 4 to 12 in. for different machine sections. Surfaces nearer the lamps dry in somewhat under 20 minutes and the lamps near these sections are turned off as soon as the wrinkle appears.

Expedites Production

Prior to the installation of the lamp bank the Haskins Company contracted its painting work to an outside firm which cured both the prime and finish coats in gas ovens. About eight hours (four hours per coat) was required to finish a set of 15 castings. The labor cost of handling the castings sent out made continuance of this practice uneconomical and time consuming and led eventually to the present operation, which has considerably expedited the production of machines at a time when the need for machine tools for defense is great.

With the present lamp bank, installed at an approximate cost of $400, the unit cost of finishing a casting has been cut exactly in half and the actual rate of finishing, disregarding time previously lost in handling and transhipping, has been increased from 15 to 24 units in eight hours.

•

Capacity Determined for Flexible Cord

Deductions formulated from test data on flexible cords used for portable electric tools indicate that the No. 18 and No. 16 A.w.g. sizes will safely carry 7 and 10 amp., respectively. These values are larger than the present values (5 and 7 amp.) allowed by the National Electrical Code. Results of tests on No. 14 A.w.g. size of cords indicate that the present value of 15 amp. is reasonable, as permitted by the National Electrical Code, 1940, and shown in the column for type R insulation in Table I.

Tests were made on the heating performance, at several current values, of rubber-insulated, rubber-jacketed cords, types S, SJ and SV of two-conductor and three-conductor construction.*

Test Procedure

Twenty-five 30-ft. samples were involved. Each cord was tested under two sets of conditions: one half was left in free air, while the other half was blanketed, using felt mats both under and over the cords.

After determining the maximum current-carrying capacity in amperes, based on test data and National Electrical Code temperature limit of 50 deg. C. at 30 deg. C. ambient, two important factors were given consideration: (1) cord heating under the blanketed condition versus that when the cord is run in free air; and (2) heating of three-conductor versus that of two-conductor cord.

* Current-Carrying Capacity of Rubber-Jacketed Cords, Bulletin of Research, No. 21, Underwriters' Laboratories, Inc., New York, N. Y.

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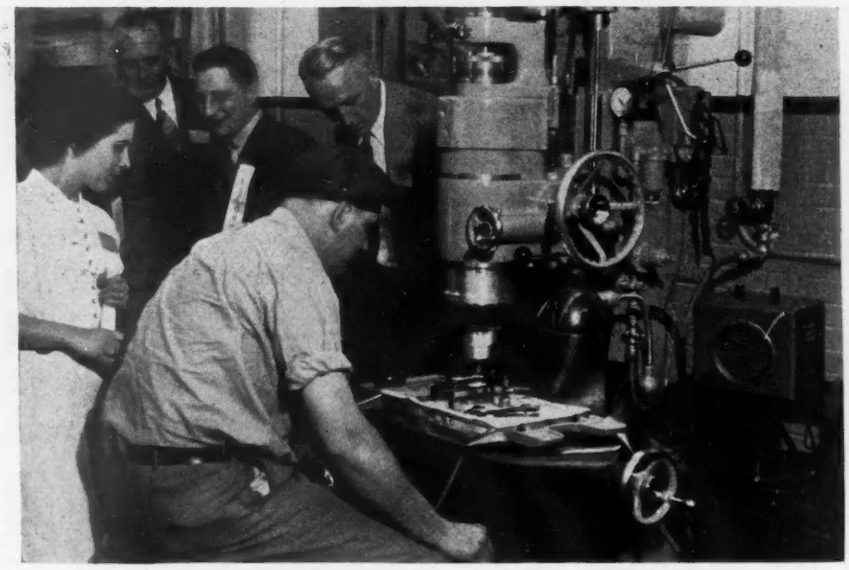
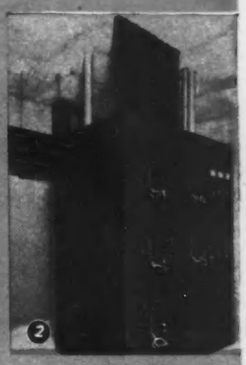
Jig Grinder Guided by Amplifier System

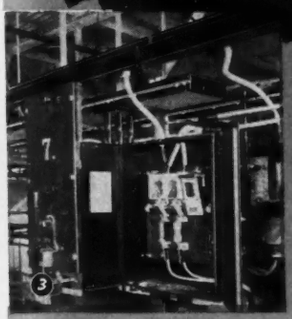


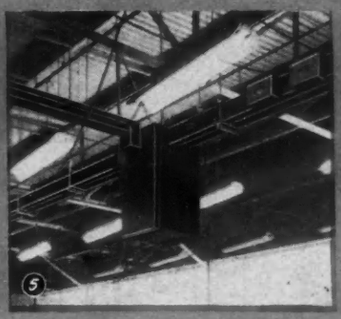
At the Merz Engineering Company's new Indianapolis gage manufacturing plant operation of this jig grinder, which finishes holes 0.020 in. in diameter, is guided by a microphonic sound-detecting device. Holes are so small that it is impossible to see when the grinding quill, imbedded with diamond dust, is touching sides of the hole. In the arrangement used the quill and work are opposite sides of an electrical circuit. As the quill touches the work the circuit to an amplifier and speaker arrangement is closed. As grinding pressure increases contact resistance between quill and work drops and the note in the speaker changes, guiding the operator.

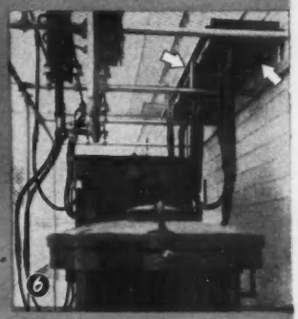
THIS NEW PLANT "Has Everything" FOR FLEXIBLE "PLUG-IN" LIGHT AND POWER



[1] From this outside Transformer Bank No. 1 (3-500 KVA, 3 phase, 220 volts), a short run of Bull Dog 4000 amp. "LO-X" BUStribution DUCT connects transformers through wall to Bull Dog Switchboard No. 1, [2] from which four runs of Bull Dog BUStribution DUCT feed into the plant. One of 1000 amp. "Plug-in" type feeds air compressors and boiler room, one of 1500 amp. "Plug-in" type leads through Maintenance Department and Tool Room to Switchboard No. 2, and

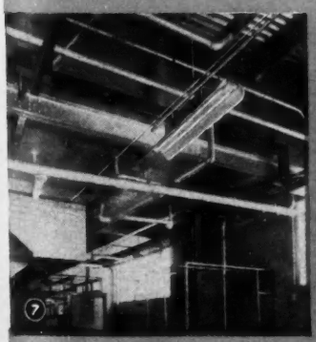


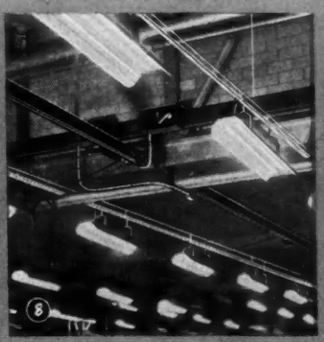




[3] two runs of "LO-X," one of 2000 amp. and one of 1500 amp. feed hydrogen brazing furnaces, as shown above. In the foreground is a run of Bull Dog Kbi-Duct enclosing wires and cables for the furnace control panels directly below. [4] This 325 foot run of Bull Dog 1500 amp. "Plug-in" type BUStribution DUCT which ties in Switchboards 1 and 2, also serves as a power plug-in source for the Maintenance Department and Tool Room.

[5] From this long run of 1500 amp. "Plug-in" type BUStribution DUCT, a run of 750 amp. branches off to the left, the tap-off being made through a Bull Dog 3 Pole 800 amp. Circuit Breaker Cubicle Adaptor. [6] This Transformer Bank No. 2 (3-200 KVA) feeds Bull Dog Switchboard No. 2, by means of a 1500 amp. "LO-X" BUStribution DUCT through wall at back of Switchboard, which is tied into Switchboard No. 1 by the





[7] run of 1500 amp. "Plug-in" type Bus Duct coming into switchboard from the left. Outgoing run at top of switchboard is Bull Dog 500 amp. "Plug-in" type, while tapping-off from this run in the upper foreground is a run of Bull Dog "125" Bus Duct. [8] Here is a run of 500 amp. Bull Dog "Plug-in" Bus Duct with runs of "125" "Plug-in" Duct, connected by means of Bull Dog Vacu-Break Bus Plugs in the 500 amp. Duct, and Bull Dog End Cable Tap Boxes in the "125" Duct.

[9] Close-up of one of the 147 ft. runs of Bull Dog "125" Duct, and of several parallel runs of Bull Dog Universal Trol-E-Duct, which feed and support the 200 watt fluorescent lights throughout the entire plant. [10] One of twelve Bull Dog Narrow Column Circuit Master Panels which feed and control runs of Bull Dog Universal Trol-E-Duct, connections being made by conduit and Bull Dog FC-2108 Outlet Box.

THESE PHOTOS of this great new defense plant show how Bull Dog Bus Duct systems provide flexible lighting throughout the plant, and flexible power, with various protective "plugs" for each individual machine. Write for Bulletins 403 and 412 describing these modern wiring systems, or better yet, ask for a call from a Bull Dog sales engineer.

BULL DOG
ELECTRIC PRODUCTS CO.
DETROIT, MICHIGAN
Bull Dog Electric Products of Canada, Ltd., Toronto, Ontario

MANUFACTURERS OF Vacu-Break Safety Switches, Circuit Master and SafToFuse Panelboards, Switchboards, Duct Systems—FOR LIGHT AND POWER

LOAD BUILDING

Salesmen Use Fact Distributor

Domestic lighting salesmen of the Public Service Company of Colorado keep themselves primed with quotable facts on the relation of lighting to physical reactions by a distinctive variation of the bulletin board idea. The facts they learn by this route slip almost unconsciously, but not ineffectively, into their sales discussions with customers.

Each day the salesmen inoculate themselves with a new fact about vision—seeing or lighting. The fact for the day, printed on a placard, is tacked to a special board in the domestic lighting department, where it remains during the day. Every morning the salesmen "quiz" themselves to see how much of yesterday's fact sunk in. Once "caught short," most Denver salesmen make it a point to see what's "up" for the day before they leave the office on their calls. To make sure that it "sticks" with them, most of the men find occasion to use it on a customer during the day.

•

Wisconsin Reviews Non-Merchandising

Positive observations, pointing toward continuance of a merchandising policy, developed six months after Wisconsin Public Service Corporation launched an experiment in non-merchandising in one division of its operation.

Early in 1939 the company ceased the sale of all merchandise with the exception of Mazda lamps at the Menominee and Marinette Light & Traction Company in Menominee, Mich., and Marinette, Wis. The public was notified of the change and sales floors were turned over to dealers for their use. Salespeople were absorbed into other departments or transferred and one man was assigned the full-time job of contacting dealers and offering help to increase their sales.

Assistance of home service, water-heating sales training and other sales and servicing experts were pressed upon dealers. Special advertising to aid their business appeared in daily papers. Dealers were asked to report their sales each month as a means of gaging the success of the plan. A special report containing the results for the two cities and other pertinent information was issued monthly.

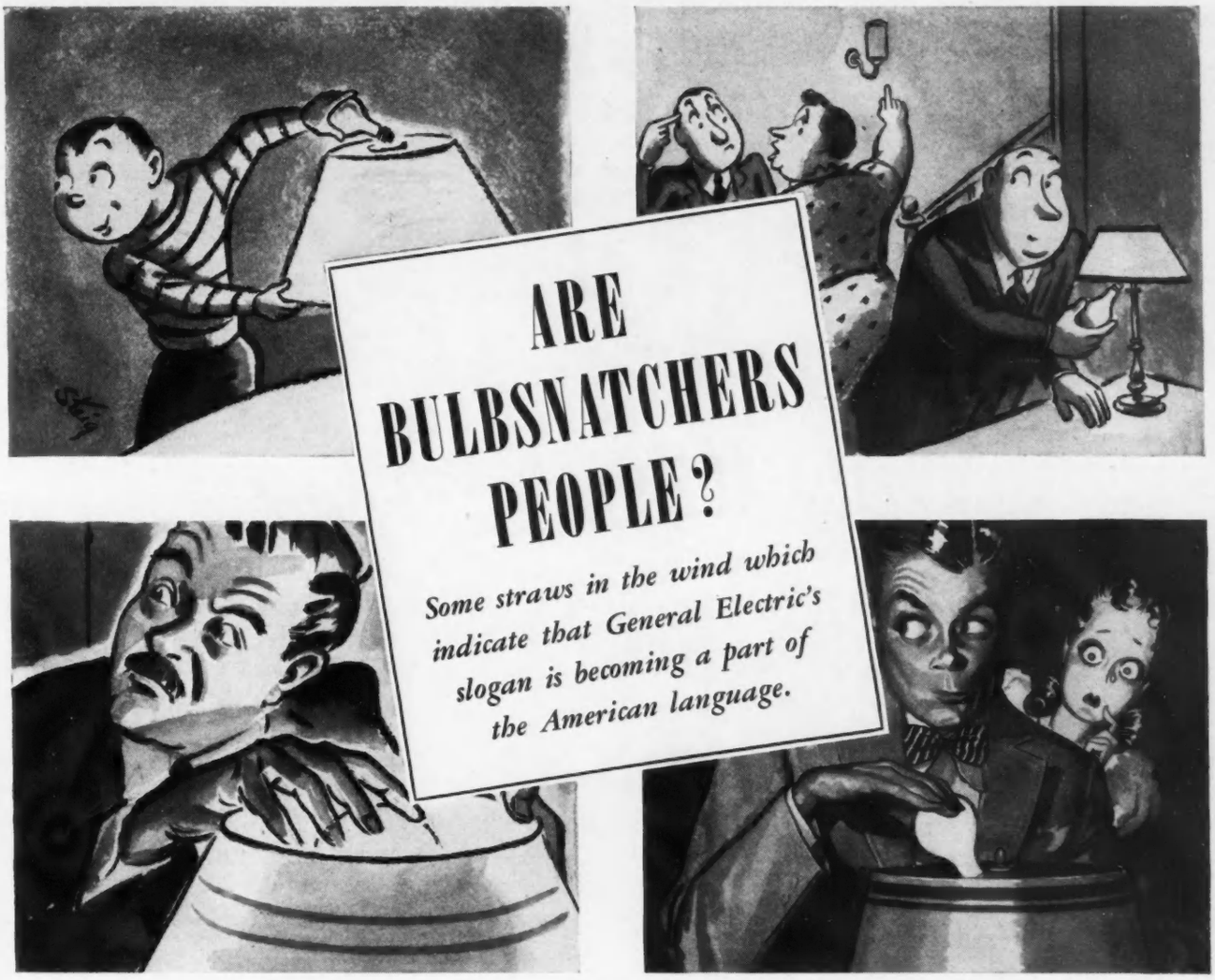
In six months the following facts were observed:

1. It was difficult to get complete and accurate reports on sales by dealers.
2. It was impossible to keep company sales floors looking respectable, as few dealers carried a big enough stock to place part of it on another floor. The larger dealers did, but there were only one or two of them.
3. Small appliance sales and displays were almost completely neglected. No small appliances were placed in the stores. Only one dealer was found who had a representative display of electric clocks in his own store, or who would care to put one in.
4. Refrigerators and washing machines were big sales items of the dealers and were sold and displayed to the exclusion of ranges and water heaters.
5. Only three automatic type water heaters were sold in the two cities (population total 25,000). Plumbers were the only ones displaying the appliance and they did little to sell them. Oil heaters and bucket-a-day coal heaters were their preference.
6. No effort was being made to keep up the quality of appliances being displayed and sold. Allowances and cut prices were gaining a foothold.
7. Dealers made no effort to secure new service customers, pushed competing fuel instead.

First change to occur in the experiment was the return of the company to active sale of water heating. Next change, during 1940, added ranges, I.E.S. lamps, and small appliances. For the present the experiment continues with washers, ironers, refrigerators, vacuum cleaners.

THINGS I NEVER KNEW
Until Now
about VISION
SEEING
LIGHTING
THAT
A Man Who Uses His Eyes Under Poor Lighting Conditions For Prolonged Periods Frequently Suffers More Nervous Muscular Tension Than A Manual Worker.

"THOUGHT FOR TODAY"—Public Service of Colorado supplies salesmen with one extra sales thought per day through this blackboard display



ARE BULBSNATCHERS PEOPLE?

Some straws in the wind which indicate that General Electric's slogan is becoming a part of the American language.

1. Street surveys show that "bulbsnatching" theme compares favorably in public consciousness with many other well-known slogans.

2. "Bulbsnatching" breaks into ditties in famous night clubs.

3. Newspaper cartoonists use "bulbsnatching" as cartoon idea.

4. "Bulbsnatching" appears frequently in magazine and newspaper editorial material.

5. Today you or your friends can hardly take a bulb out of a lamp without somebody calling you a "bulbsnatcher".

All of which, we believe, indicates that our bulbsnatching series is performing a real service to the reader—reminding him that it's silly to risk eyestrain when G-E bulbs cost so little.

We believe there's a moral in this for you. With more and more people becoming conscious of "bulbsnatching" and empty sockets, lamp and lighting activities should be particularly effective this fall.

Consciousness of bulbsnatching is growing. We invite you to tie in with it locally whenever possible.

G-E MAZDA LAMPS

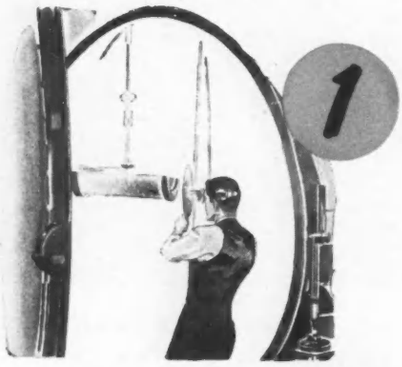
GENERAL ELECTRIC

Here's your key to dependable

..THE FLEUR·O·LIER

specify fixtures backed by

FLEUR-O-LIER'S NEW 4-POINT PROGRAM



TESTED Famous, impartial Electrical Testing Laboratories put Fleur-O-Lier fixtures through exhaustive tests which include checking such vital points as flicker correction, durability and safety, ease of maintenance, dependable ballasts and starters, efficient lighting performance, high-power factor (over 85%). These rigid tests protect *you* . . . give your customers definite assurance on features they want.

CERTIFIED Based on these tests, Electrical Testing Laboratories gives the Fleur-O-Lier Manufacturer the right to affix the label of certification to all fixtures identical to the sample submitted. This label is your assurance that the fixture wearing it meets the 50 rigid specifications set up by MAZDA lamp manufacturers for better light and better service. You can buy or sell Certified FLEUR-O-LIERS with confidence!

3
FLEUR-O-LIER
Manufacturers
GUARANTEE
This certified Fleur-O-Lier, when properly installed and equipped, is guaranteed to be free from defects in material, workmanship or assembly for a period of ninety (90) days from date of delivery to purchaser. Should any such defects appear within that time and under normal conditions of use, the undersigned company will furnish new material or parts in exchange for any found defective and will correct any faulty workmanship or improper assembly.
Fleur-O-Lier specifications require the use of certified auxiliary parts.
(NAME OF MANUFACTURER)

GUARANTEED Certified FLEUR-O-LIERS are guaranteed by their manufacturers to be free from any defects of material, workmanship and assembly for a period of 90 days. Note the complete guarantee shown here with which every Fleur-O-Lier Manufacturer complies.

FLUORESCENT LIGHTING LABEL

Certified
FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
which are sponsored by the Manufacturers of Mazda Lamps
ELECTRICAL TESTING LABORATORIES
NEW YORK, N. Y.
E·T·L
A COPY OF THIS CERTIFICATE SHOULD APPEAR UPON EACH UNIT OR PACKAGE
E·T·L
FLUORESCENT LIGHTING FIXTURES EMPLOYING EXISTING TYPES OF LAMPS ARE NOT RECOMMENDED FOR SCHOOLS, OFFICES AND SIMILAR LOCATIONS UNLESS LAMPS ARE SHIELDED FROM DIRECT VIEW
THIS CERTIFICATION IS CONTINGENT UPON EMPLOY
OF CERTIFIED AUXILIARIES OF OVER 85% POWER FAC

4 ADVERTISED

Over 25,000,000 FLEUR-O-LIER advertising messages makes the Fleur-O-Lier program the largest ever put behind fluorescent lighting fixtures in any three months' schedule. Headed by SATURDAY EVENING POST, TIME, NEWSWEEK, NATION'S BUSINESS, BUSINESS WEEK and UNITED STATES NEWS, this gigantic consumer, trade and business magazine schedule reaches the *majority* of your commercial and industrial customers . . . urges them to come to you for sound engineering advice when they buy fluorescent lighting!

The Fluorescent Futurama, *an amazing exhibition of the latest in certified lighting fixtures will be shown this fall in: Albany, Boston, Hartford, Allentown, Wilkes-Barre, Indianapolis, Omaha, Miami, Atlanta, Birmingham. Tentatively planned are: Memphis, New Orleans, Houston, Dallas.*

Get this new book *FREE*

Just reprinted, it tells all about Fleur-O-Lier fixtures and describes in detail the 50 standards to which they are built—and shows how many of the tests are made. Your request will be filled at once and will also include a list of the manufacturers now making Certified Fleur-O-Lier equipment.

FLEUR-O-LIERS

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

TEAR OUT AND MAIL

FLEUR-O-LIER MANUFACTURERS
2126-10 Keith Bldg., Cleveland, Ohio

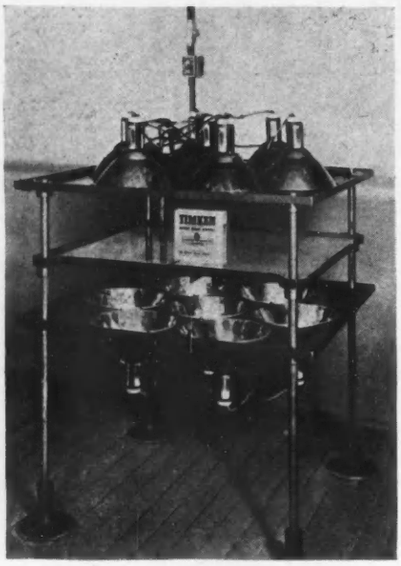
Please send me FREE new booklet "50 Standards for Satisfaction," together with list of Fleur-O-Lier manufacturers.

Name _____

Address _____

City _____ State _____

Infra Red at Canton Cuts Three Operations



Timken Roller Bearing has developed a novel device at Canton, Ohio, employing 1,750 watts of infra red to heat bearing cones preparatory to assembling them on shafts where a tight press fit is required.

This device consists of three trays about 4 ft. square, approximately 12 in. above each other. The middle tray is of Pyrex glass, while the top and bottom trays each carry seven 250-watt infra-red lamps with gold-plated reflectors.

Bearing cones are not taken out of the boxes, but are stacked in their containers. About 20 minutes is required to heat a bearing up to a maximum of 155 deg. F. The infra-red rays penetrate the boxes, heat the steel, but leave the cardboard relatively cold.

Furthermore, when this method of heating is used, it is not necessary to wash off the protective coating which is put on the bearings at the time of packing.

•

Modernizes Drafting Board Lighting

Something more than the replacement of one type of fixture with another was responsible for the improvement of the illumination in the drafting room of the engineering firm of J. E. Sirrene & Company, Greenville, S. C. The original installation had a sawtooth roof with exposed beams overhead and was equipped with 150-watt reflectors on 8x12-ft. spacing, with a mounting height of about 12 ft. above the floor. The drafting boards were also provided with swinging arm lamps in deep bowl reflectors to give intensive illumination over limited areas of the boards. There was considerable absorption of light in the upper part of the room with the type of ceiling construction employed.

In designing the new installation the primary objective was the lighting of the drafting boards and not the room as a whole. The final layout was the result of several trials made over a small section of the room, to determine the best arrangement for uninformity and absence of shadows. In the new system a false plywood ceiling was provided, four exhaust fans being located in the space above and with ventilating grill openings flush with the ceiling. Eighty-four 100-watt Wheeler No. 4,945 fixtures were installed to serve 3,625 sq.ft. of floor area, and 9 ft. above the floor. Drafting boards are 3 ft. 4 in. high.

Units are controlled in ten groups from panels providing for individual switching for each board. "Hot" convenience outlets over each board for accounting machines are also provided. All units are quickly detachable from the ceiling by hooks, receptacles and plugs; they have the same length of cords and thus are interchangeable. A separate pilot lighting system is installed, and walls and ceilings were double-coated with paint.

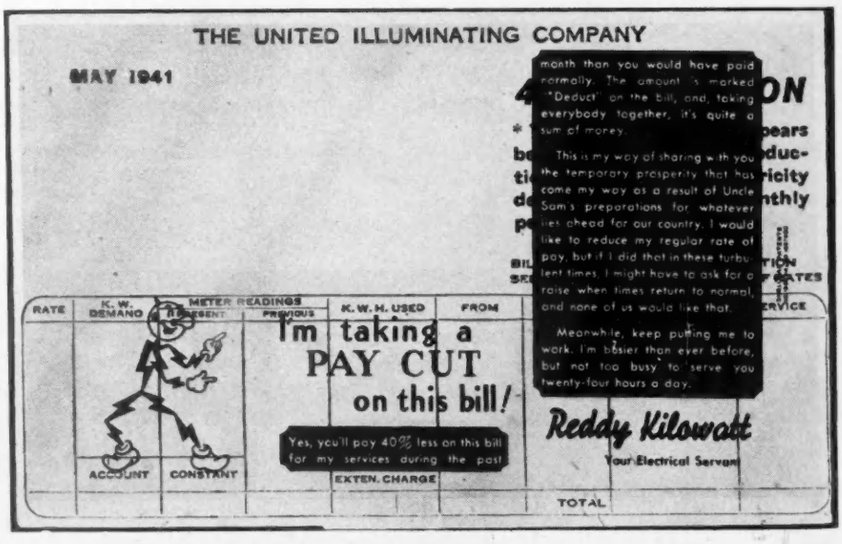
With all units hanging vertically, sharp shadowing fell on the left sides of triangles at the ends of the boards. This was eliminated by tilting the lengthwise rows of units until they "cut off" to the left. The Sirrine company reports that while the total amount of energy used is about the same as previously, the average intensity at the drafting boards using daylight lamps was about 52 ft.-candles initially and after 3-5 months' service was about 42 ft.-candles under zero natural light. Two 40-watt daylight fluorescents are used per fixture.

•

Reddy Takes Pay Cut in New Haven Bills

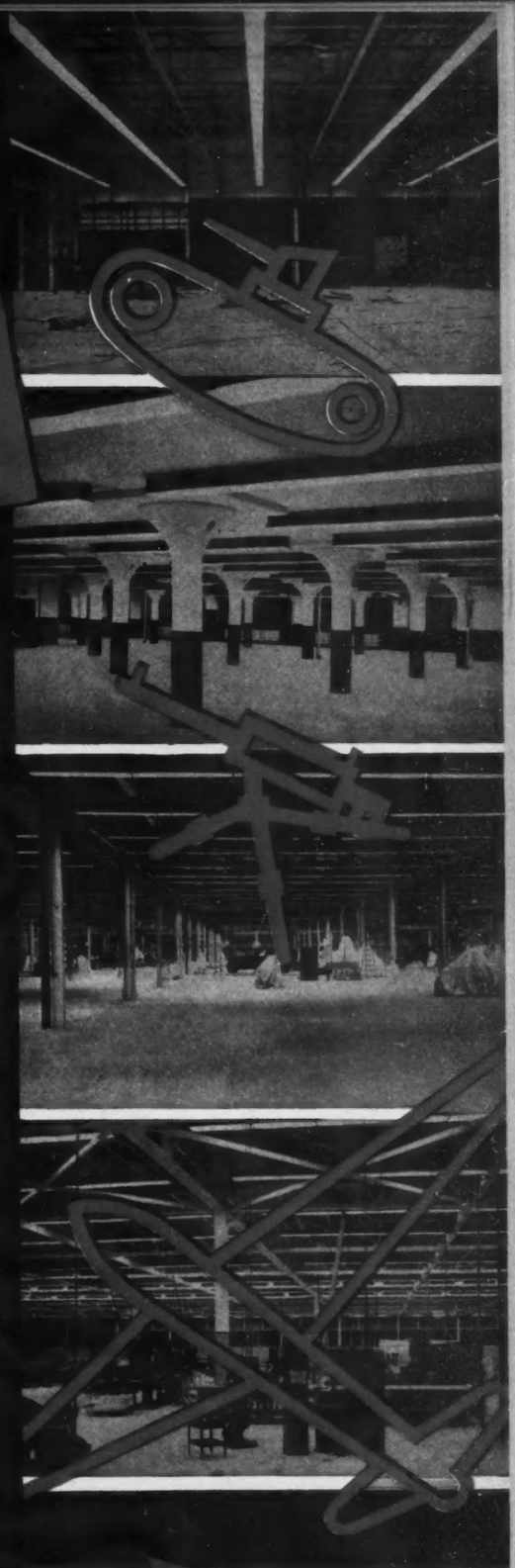
Dividends to customers are no longer uncommon, but the United Illuminating Company devised a distinctive way to convey the news of a 40 percent reduction on bills for May readings. Advance announcement was given in March that this would be done, but the psychological effect was focussed on the bills themselves. So that the addressograph legend could show through the envelope window, a cellophane sticker was printed (by Shellmar Products of Mt. Vernon, Ohio), in such manner that the message was concealed until the customer opened the bill.

The bill itself also carried a more formal but brief statement so that the customer would have it for reference if he saved the bill without the sticker. Incidentally the billed item was for the amount based on the standard rate with a subtracting item to represent the May deduction.


THE UNITED ILLUMINATING COMPANY
MAY 1941
month than you would have paid normally. The amount is marked "Deduct" on the bill, and, taking everybody together, it's quite a sum of money.
This is my way of sharing with you the temporary prosperity that has come my way as a result of Uncle Sam's preparations for whatever lies ahead for our country. I would like to reduce my regular rate of pay, but if I did that in these turbulent times, I might have to ask for a raise when times return to normal, and none of us would like that.
Meanwhile, keep putting me to work. I'm busier than ever before, but not too busy to serve you twenty-four hours a day.
Reddy Kilowatt
Your Electrical Servant
RATE
K.W. DEMAND
METER READINGS PRESENT
PREVIOUS
K.W.H. USED
FROM
I'm taking a PAY CUT on this bill!
Yes, you'll pay 40% less on this bill for my services during the past
ACCOUNT
CONSTANT
EXTEN. CHARGE
TOTAL

CELLOPHANE STICKER over bill face carries message of "customer" dividend on May bills

MILLER LIGHTING *for Defense*



MORE THAN 100 MILES of IVANHOE "50 & 100 FOOT CANDLERS" are today speeding defense by providing better working light — in armories, arsenals, airplane and parts plants, in the factories of direct defense suppliers. Every single feature of this *guaranteed* and *proven* fluorescent lighting system makes direct, immediate contribution to the defense effort.

★ ***HIGHER ILLUMINATION***—50 to 100 foot candles—for faster, better production —greater worker efficiency.

★ ***30 TO 50% LOWER INSTALLATION COSTS***—Fixtures contain up to 80% of necessary conduit—makes defense dollars go further.

★ ***FASTER INSTALLATION***—Steps up building schedules — plants get into production quicker.

★ ***UNIFORM LIGHT DISTRIBUTION***—Production equipment can be moved at any time without necessity for changing lighting.

★ ***SIMPLIFIED MAINTENANCE***—Easy to clean, removable porcelain-enameled reflectors —saves valuable man-hours for production.

★ ***ALLOWANCE FOR FUTURE LIGHTING NEEDS***—Illumination increases up to 45% practical without new fixtures—low obsolescence factor.

With the need for night work growing still greater . . . with the heat on for faster and faster delivery of defense goods, IVANHOE "50 & 100 FOOT CANDLERS" become more than ever valuable defense weapons. If you, too, are serving for defense, perhaps we can help you.

The Miller Company, now serving for defense, stands ready to serve still further.

LLER DEFENSE INSTALLATIONS

LLER-IVANHOE "50 & 100 OOT CANDLER" installaons represent a "roll call" r defense. Here are a few f the many:

Springfield Armory
Frankford Arsenal
Curtiss-Wright Corp.
Grumman Aircraft
Republic Aviation Corp.
Fairchild Aviation
Liberty Aircraft Products
Uxbridge Worsted Co.
Sperry Gyroscope Co.
Ranger Engineering Corp.
United American Bosch
Murray Body Corp.
Pratt and Whitney

PRESIDENT TO ASK NEW ARMS FUNDS; MORE NIGHT WORK

From N. Y. Times Sept. 2nd

★★★★★★

IVANHOE "50 FOOT CANDLER" "100 FOOT CANDLER" RLM Continuous Wireway FLUORESCENT LIGHTING SYSTEM

THE MILLER COMPANY

MERIDEN, CONN.

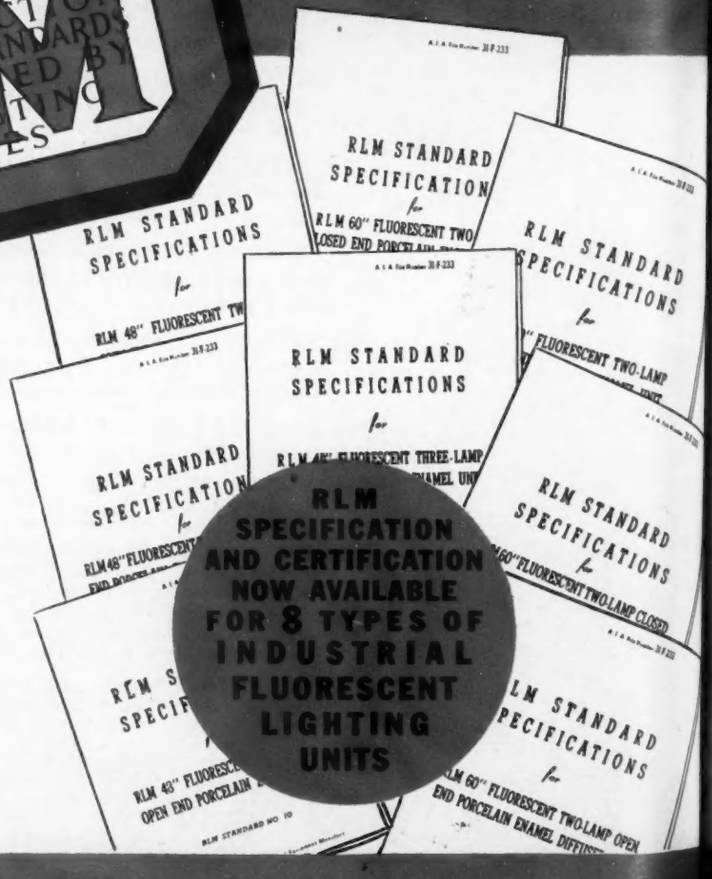
Pioneers in Good Lighting Since 1844

You can see this guaranteed and proven Fluorescent Lighting System at the Fluorescent Futurama visiting 10 leading cities.

● MILLER OFFERS A COMPLETE LINE of incandescent and fluorescent lighting equipment, backed by almost 100 years of commercial and industrial lighting specialization. There is an answer to your problems in this unbiased lighting service.

Your ASSURANCE *of* INDUSTRIAL *Fluorescent*

This Label on an Industrial Fluorescent Lighting Unit Certifies that it has been Manufactured in Compliance with Quality-Assuring Specifications under the Exacting Procedure Developed and Administered by RLM Standards Institute


RLM STANDARD SPECIFICATIONS for
RLM STANDARD SPECIFICATION for
RLM 60" FLUORESCENT TWO
RLM STANDARD SPECIFICATIONS for
RLM STANDARD SPECIFICATIONS for
RLM STANDARD SPECIFICATIONS for
RLM STANDARD SPECIFICATIONS for
RLM 60" FLUORESCENT TWO-LAMP OPEN END PORCELAIN ENAMEL DIFFU
RLM SPECIFICATION AND CERTIFICATION NOW AVAILABLE FOR 8 TYPES OF INDUSTRIAL FLUORESCENT LIGHTING UNITS

YOUR GUIDE TO UNIFORM, HIGH QUALITY AND TROUBLE-FREE OPERATION

Today, with the National Defense Program calling for maximum production...and with skilled workers at a premium...*better seeing* has become a first essential for both night and day workers.

In meeting this responsibility by providing better light for better sight, insist on industrial lighting fixtures bearing the RLM Label. This simple buying step is your best assurance that the lighting units you install will provide the maximum value in lighting efficiency and economy . . . give maximum protection to the eyesight and health of your workers, and help them maintain high standards of accuracy and efficiency.

Guarantee

All RLM certified fluorescent lighting units are guaranteed against mechanical and electrical defects for a period of ninety (90) days from date of delivery to the purchaser. Correction of such defects by repair or replacement of material only shall constitute fulfillment of all obligations under this guarantee by the undersigned manufacturer or its distributor.

RLM certified fluorescent lighting units are engineered for operation with Mazda fluorescent lamps to give maximum light output and trouble-free operation when properly installed and under normal conditions of use.

WRITE FOR COPIES OF THESE SPECIFICATIONS

The RLM Standards Institute is a non-profit organization operated to develop and promulgate standard specifications for the efficient performance of industrial lighting equipment.

Efficient and Effective LIGHTING....

RLM SPECIFICATION and CERTIFICATION SERVICE

Basic to proper light conditioning in your plant are the RLM Specifications. Established by exhaustive research and scientific tests, these specifications establish dependable standards of performance, output and quality.

Continuous conformity to RLM Specifications by manufacturers of RLM labeled Industrial Fluorescent Lighting Units is assured by a rigid and continuous inspection and testing system conducted by Electrical Testing Laboratories . . . an independent testing organization. This certification service is the user's warranty that the features, auxiliary control equipment, sockets and other component parts used in RLM labeled Industrial Fluorescent Lighting Units are properly engineered for co-ordinated operation with Mazda Fluorescent Lamps to give maximum light output and trouble-free operation.

Certified
RLM FLUORESCENT UNITS
are engineered
FOR OPERATION
with
MAZDA FLUORESCENT LAMPS

The Letters RLM Stand for Reflector and Lighting Equipment Manufacturers

RLM STANDARDS INSTITUTE
INCORPORATED

307 N. MICHIGAN AVE. • SUITE 1600 • CHICAGO, ILL.

NEW ENGINEERING IDEAS

Model Test Avoids Gate Reconstruction

By R. C. STRAUB
Engineering Department,
Wisconsin Public Service Company, Green Bay

Upstream improvements, invelving enlargement of a dam to pass a greater flow, increased the maximum expected flow rate at our Hat Rapids hydro station to 14,300 sec.-ft. This development made it necessary that we know whether the greater flow could be safely passed by the dam. Present floodgate openings, 10 ft. wide by 18 ft. high, are narrow and deep compared to modern gate openings, and are separated by 6-ft. wide square-nosed piers. The gates are closed by wooden stop logs.

Calculation of the discharge for this design was a doubtful process leaving two courses open: (1) To determine by a model test whether present openings were adequate, or (2) to reconstruct the dam to provide new gates and piers which would be adequate. If the present openings were of sufficient capacity, modern steel tainter gates could be installed which would cost $10,000 less than the reconstruction method.

The model test was, of course, the logical choice. From the tests, which will be described, we found that the discharge capacity of the dam, as indicated by the model, at a head higher than normal, but well within the safe operation of the dam, was 16,700 sec.-ft. or 2,400 sec.-ft. greater than the expected maximum flow rate.

To make this determination a wooden model of one of the gates was constructed to a scale of ½ in. to 1 ft. This gate was placed so that water flowed from an upper pool through the gate to a lower pool, through a stilling screen and over a rectangular sharp-edged weir. To simulate the width of the river above the dam, training walls were extended upstream from the piers, confining the water flowing into the model. Similarly, training walls were extended downstream along the apron to proportion the width of the apron to the gate, so that the water would not flow away faster than it should.

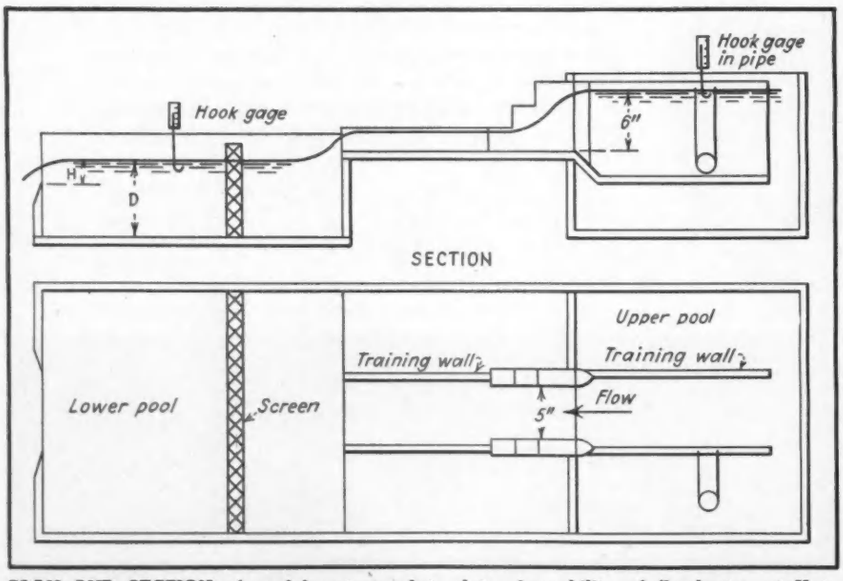
Control of flow was attained by a valve and pipe in the upper pool. Headwater level in the upper pool was maintained with a hook gauge. The lower pool was held at about tailwater level. This level determined the head on the weir, as measured with another hook gauge.

The King* formula, modified, was most suitable for both flow and calculations. In this formula:

$$Q = 3.34\,LH^{1.47}\,[1 + 0.56\,(HL/DW)^2]$$

L is length of weir, less 0.2 H for end conditions; H is head on the weir; D is depth of water above the weir and W the width of channel of approach. In the modification $(HL/DW)^2$ was substituted for $(H/D)^2$ to compensate for the greater channel of approach width compared with the length of the weir, reducing the effect of velocity of approach and consequently discharge.

Observed readings from the model substituted in this formula gave discharge of the weir, which was identical for the model gate. This discharge substituted in the formula $Q = CLH^{3/2}$ gave the coefficient of discharge C of the model gate, L being its width and H the head on the gate. This coefficient was the primary goal of the test, since it could be applied directly to the full-size gate to



PLAN AND SECTION of model gate used to determine ability of floodgates at Hat Rapids hydro station to handle increased flow

* From Kings Handbook of Hydraulics, 1929 (McGraw-Hill).

The LARGEST Manufacturer of Public Utilities Equipment

Here is the largest and best equipped plant in the country devoted exclusively to the manufacture of public utilities equipment. Machines are modern, highly specialized, and manufacturing processes have been developed to the highest point of efficiency. The workers have been carefully trained in their respective operations, supervision is by competent engineers, and inspection at every stage is most exacting.

The dominant position of American is not accidental. Large quantity production is the natural consequence of high quality products. By far the greater part of American's business consists of repeat orders from old customers. Not only quality of products, but strict fairness and impartiality governing all business relations contribute to the upbuilding of this great business. Size of order makes no difference. Every company's business is equally valued and receives the same careful attention and service.

Line Construction Bodies
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MANUFACTURER OF STANDARD EQUIPMENT FOR PUBLIC UTILITIES

determine its discharge in the same formula where L and H were width and head of the prototype. Computation revealed that the discharge was large enough to take care of the maximum expected flow so that present openings could be used by replacing stop logs with tainter gates.

Accuracy of the weir was checked by placing stop logs in the bottom of the model and determining corresponding coefficients. These were plotted against head over the stop logs. A smooth elongated S curve resulted, with coefficients increasing rapidly at first and then slower as head decreased, approaching constant value at low heads.

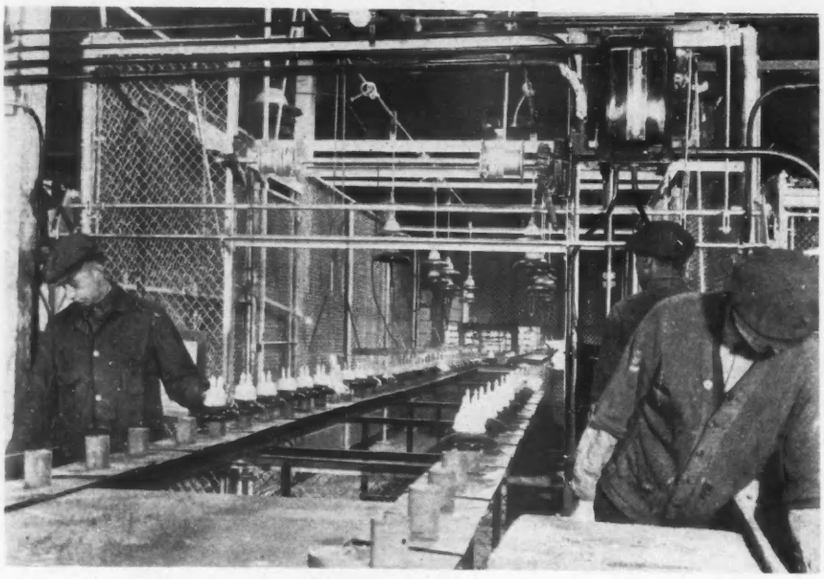
•

Insulator Testing on "Production Line"

By EDWIN M. MEYER
Commercial and Industrial Engineer
Victor Insulators, Inc., Victor, N. Y.

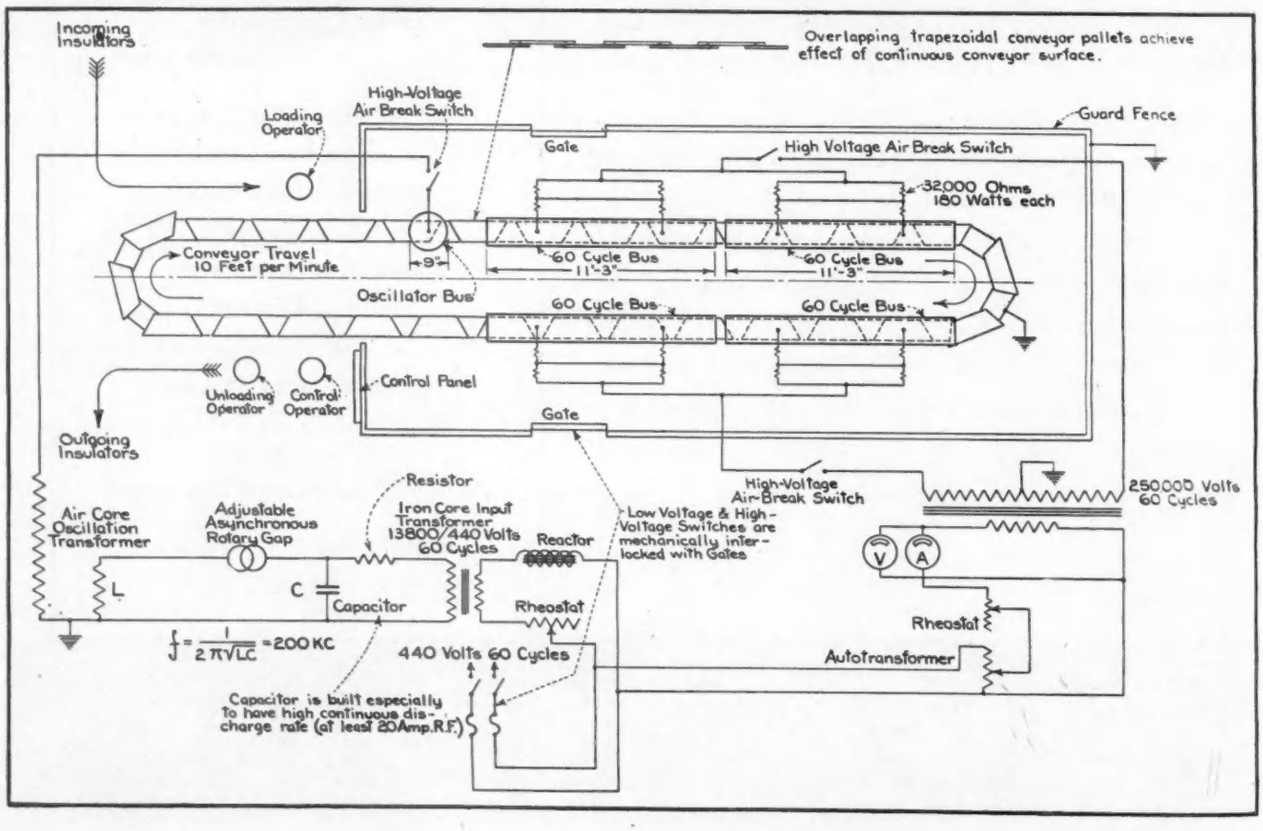
To permit testing of distribution insulators in accordance with Standard No. 41 of the American Institute of Electrical Engineers on a "production line" basis, some insulator manufacturers use a continuous conveyor test bus arrangement, such as the Victor test conveyor shown.

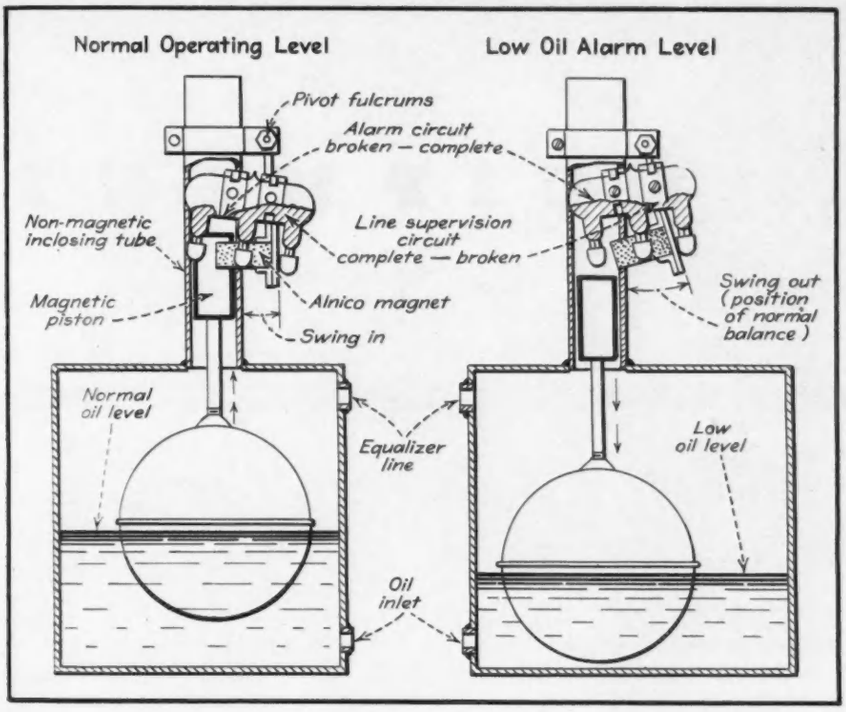
In this method, which involves continuous travel of insulators on an oval conveyor track under a preliminary oscillator bus and then under a 60-cycle bus arranged in two half-sections on opposite sides of the track, the caps of the insulators do not make direct contact. Instead, a series gap is used between each unit and the bus and individual contact is made by intermittent sparking which carries the combined sparkover and charging currents of each unit to



CONVEYOR arrangement permits continuous flashover tests on distribution insulators

Loading operator (left) places 6-in. suspension insulators on pedestals on grounded conveyor pallets which carry units into screened inclosure and under high-voltage bus, delivering them at the discharge end of the bus to the unloading operator (right foreground). Control operator (with back to camera) can control value of oscillator and 60-cycle voltage, de-energize either bus at will, start and stop the conveyor and adjust height of bus above insulators during test. Oscillator bus is adjusted for five-second flashover. Two 60-cycle busbars, used in tandem, are each adjusted for 2½-minute flashover. Busbars are excited from drop leads through top of grounded inclosure.





LOW oil level alarm for power transformers protects against equipment failure

ground. The operator controls and stabilizes the flashover characteristic by adjustment of series gap length as suited to the individual capacitance of the units under test. By proper adjustment he can keep every unit under the bus sparking over a maximum number of times a second.

The series gaps make effective detectors of faulty units. Sudden burning through of a flaw causes an immediate increase in gap current, changing the gap characteristic from a group of sparks to a luminous dynamic arc. This arc signals the location of the punctured unit and reduces the potential from busbar to ground so that all other good units stop flashing over. Normal conditions are at once restored when the faulty unit is removed from the conveyor line.

•

Alarm Relay Indicates Low Oil Level

A new float-actuated, oil level alarm relay for power transformers and high-voltage oil circuit breakers, recently introduced by the Fred H. Schaub Engineering Company, Chicago, provides utility substations with an automatic device which can be used to sound an audible alarm or remove equipment from service should oil level drop for any reason. The relay is arranged for installation on a transformer or its oil reservoir.

Essential elements of the device are shown in the accompanying illustrations. It consists of a totally inclosed, packless float chamber and vertical inclosing tube that extends up into a separately inclosed relay chamber. A float ball riding on oil in the float chamber (which is connected by inlet and equalizer lines to the transformer oil reservoir) carries a ferrous piston up into the nonferrous inclosing tube in the relay chamber. A pivoted armature in the relay chamber supports an "Alnico" magnet to which a SPDT mercury tilt tube is attached. The tilt switch is actuated by the permanent magnet as it follows the motion of the ferrous piston as the float ball follows changes in oil level.

In the accompanying diagram the position of the piston and magnet armature is shown under normal and low oil level conditions. In the normal position the magnet is attracted to the piston holding the tilt-tube at the indicated angle. In this position a circuit is completed, operating a green, line supervision light. In the low level position the piston is below the magnetic line of force, allowing the magnet and switch assembly to swing out of position of natural balance. In this position the switch is tilted in the opposite direction and the circuit is made to a warning alarm and broken to the line supervision light.

The single-pole, double-throw mercury tilt switch is rated at 1 hp. and can be arranged in a number of ways to provide visual and audible signals or to initiate breaker operation. Due to the weight distribution of the switch relay, the force of the Alnico magnet is relied upon to hold the switch in normal safe position when the oil level is satisfactory. Should the magnet lose its strength the switch relay will swing out to the position of its natural balance, sounding the alarm, and if such failure should occur the control would fall "safe."

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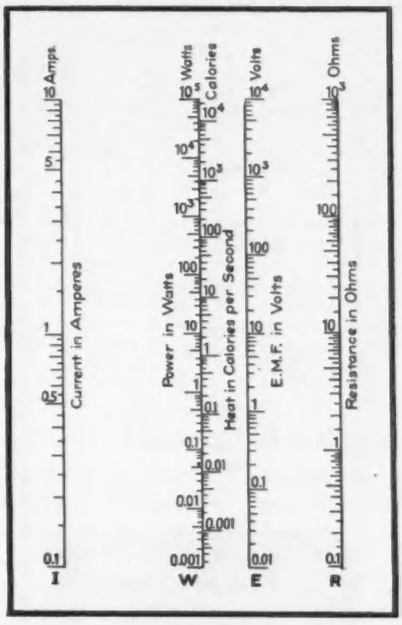
Nomogram Is Based on Ohm's Law Formula

By D. J. WILLIAMS
Birkenhead Institute, England



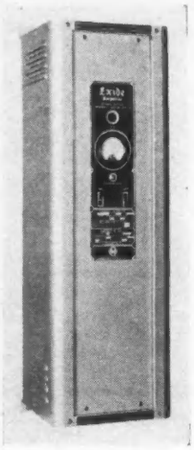
VOLTS, power and heating effect determined when current and resistance are known

A nomogram has been constructed, developed on the principle of addition of reciprocals and using Ohm's law formula ($E = IR$) as a basis, for determining volts, resistance, current, power and heating effect when any two values are known. Spacing of the scales must be maintained, as shown. By placing a straight edge at points on any two scales, the resultant value may be read directly on another scale.

NEW EQUIPMENT

Emergency Light Units

Four new emergency light units consist of a storage battery and charge and control equipment for automatic operation. Upon failure of the normal a.c. supply the battery is transferred instantaneously to the emergency lighting circuit. When the a.c. supply is restored, the emergency lighting circuit is transferred back to the a.c. supply. The battery is kept fully charged at all times, it is claimed, by high-rate charge after normal power is restored and then by trickle charge.



Exide charge and control equipment of storage battery emergency light units: capacities range from 3400 to 10,000 watts, for operation on single-phase, 2-wire, 115-volt, 3-wire, 115/230-volt, and 3-phase, 4-wire, 115/199-volt, 60-cycle systems. **The Electric Storage Battery Co.**, Philadelphia, Pa.

•

Electronic Control

Automatic control utilizing electronic devices has been made available to control the mechanical feeding of pulverizing machinery. It comprises a control unit, which connects to the magnetic contactor switch of the feeder motor, ranging from 1 to 5 hp. in the usual installation. The control is set for the full-load current of the grinder motor, and keeps check through its load-range regulator. Signal lights indicate operating conditions.

Pulverizer feeder electronic control: capacities, up to 250 hp. for grinder motor, 5 hp. for feeder motor; standard voltages a.c.; control, 110 volts, 60 cycles. **Max Mosher**, 130 W. 42nd St., New York, N. Y.

•

Temperature Indicator

Micromax model "S" indicator; measures 50 couples, which are indicated only. **Leeds & Northrup Co.**, 4934 Stenton Ave., Philadelphia, Pa.

A large number of thermocouple temperature readings can be taken, in any desired order, by a new automatic indicator which is essentially a Micromax strip-chart indicating recorder, minus the recording mechanism. A self-contained, double-throw toggle switch with spring return to neutral connects the indicator to either of two couples. With the toggle in the neutral position, the couple is disconnected or, when specified, reconnected to a recorder from which it was temporarily disconnected for the indicator reading.

•

Resistance Welder Control

Power and control units: contactor capacity up to 600 amp., with synchronous and non-synchronous timers; 220 or 440 volts. **Weltronic Corporation**, 3080 East Outer Drive, Detroit, Mich.

Complete power and control units for resistance welding are now available in one cabinet, simplifying wiring connections. Devices assembled in steel-back panel cabinets include contactors and firing relays, sequence timer, protecting fuses, limit switches, motor starter, low-voltage transformer and relay. Similar units, without ignitron contactors and firing relays, are available for controlling operation of automatic machines.

Who Makes What?

"Electrical Buyers Reference," published annually. **McGraw-Hill Publishing Company**, 330 West 42d St., New York, N. Y.

Names, addresses and products of electrical manufacturers are catalogued in this convenient, annual publication for public utility, industrial, engineering and other major electrical buying interests.

Voltage Divider

Decade voltage divider: four sets of resistances in ranges 0-10, 0-90, 0-900 and 0-9,000 ohms, in each of two branches; voltage ratios of 0.0001 to 1.0. **Shallcross Manufacturing Co.**, Collingdale, Pa.

Resistance box of the decade type has four dials, four terminals, and coupled taps on each of two branches of resistance which may be used independently. When dials are rotated clockwise, resistance in one branch is increased and in other branch decreased. When used as a voltage divider, a link is placed across the two inside terminals. This makes the resistance connected to the two outside terminals constant at all settings of the dials, it is claimed. Voltage ratio is indicated by the dial settings.

•

Vise

Capable of developing pressures up to 5 tons between jaws, a new hydraulic vise is suitable for maintenance and machine shops in utility and industrial plants. Pressure to close jaws is controlled by a foot-pedal pump. Front jaw is stationary. Hydraulic fluid operates ram on back jaw. One pedal moves jaw to contact against work. A second pedal applies pressure. A third pedal releases the jaw.

Hydraulic vise: sizes, 5 in. and 7 in. width between jaws; can be mounted horizontally or vertically. **Studebaker Machine Co.**, 9 South Clinton St., Chicago, Ill.

Grand Champion

A "Grand Champion" horse in the highly trained gaited classes has won his place through proficiency in two general classifications—conformation and performance. We all know about "performance" whether it concerns horses or Pole Line Hardware, but conformation is something vastly different, though closely related.

With horses it is the shape of the head, the contour of body and legs, the placement and carriage of ears, mane and tail. A horse is *born* with it or without it. In hardware it is "design", and must be *put into* the article by someone who *knows*.

Hubbard 4-11-44 Wireholders have "clicked with judges" all over the world. Their design has been approved, tested and checked by "performance" for many years and under all conditions.

If you have not yet used the BLUE RIBBON 4-11-44 Hubbard Wireholder, you are in for a pleasant surprise. Write for a sample to look over and test—and "judge" for yourself.

HUBBARD AND COMPANY
PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

Write for Sample to
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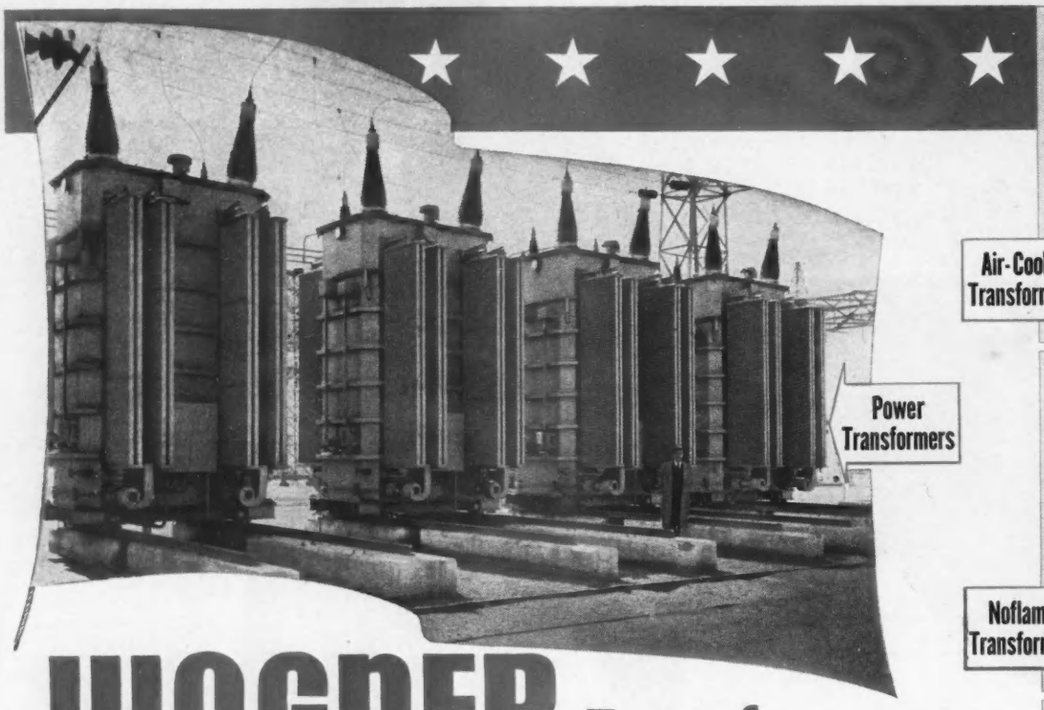
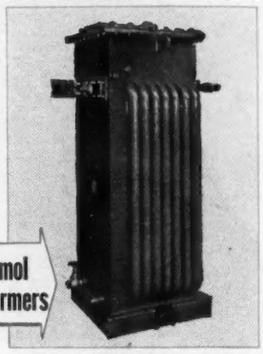
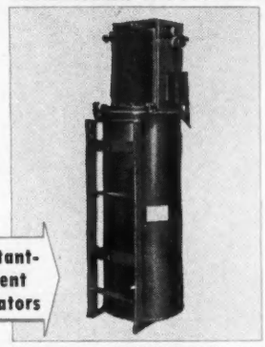
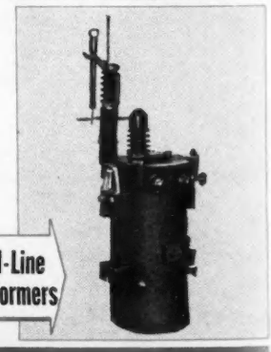
Advertising Department
6301 Butler St. Pittsburgh, Pa.

ANG THE LOAD ON HUBBARD HARDWARE"









WAGNER Transformers

ARE DOING THEIR PART IN *SPEEDING UP* OUR NATIONAL DEFENSE PROGRAM

Continuous, uninterrupted service is always a vital necessity in the power industry. Public confidence rests upon the ability of power companies to serve their customers 24 hours each day with absolute dependability. With the speeding up of industry in general to meet defense needs, continuity of service in the power industry becomes even more important.

The transformer is one of the vital links in any power distribution system. If the transformers give trouble, unsatisfactory service results and operating costs go up. The selection of transformers, since it affects both the consumer and the power company, is a matter that should receive very careful study.

The actual performance record of Wagner transformers in service is your assurance that Wagner transformers will give years of continuous, uninterrupted service, and be a credit to your system. In all parts of the country Wagner transformers are establishing records for continuity of service.

Every Wagner transformer has the benefit of nearly 50 years of transformer engineering experience... experience in building all types and sizes of transformers. No matter how varied your requirements, Wagner transformers will do the job. The same high quality goes into the construction of every Wagner transformer. Specify Wagner on your next request for quotation.

WAGNER ELECTRIC CORPORATION 50TH 1891 • 1941 ANNIVERSARY ST. LOUIS, MO.

50 YEARS OF SERVICE

This year Wagner celebrates its fiftieth year of service to industry and the home—as a manufacturer of motors, transformers, and fans of the highest quality.

T41-16

Wagner Electric Corporation

6400 Plymouth Avenue, Saint Louis, Mo., U.S.A.

TRANSFORMERS • MOTORS • FANS • BRAKES

MANUFACTURING-MARKETS

Refrigerator Sales Up; Ranges Spurt

Domestic sales of electrical household refrigerators during the month of August amounted to 251,621 units, compared with 315,682 units in July, and 191,981 units in August, 1940. These data were issued by the National Electrical Manufacturers Association and were based on reports received from eleven companies in 1941 and 14 companies in 1940.

For the first eight months domestic sales amounted to 2,847,751 units, compared with 2,160,684 units for the similar period of 1940.

Foreign sales advanced to 10,980 units in August this year from 5,591 units last August, and for the eight-month period to 97,602 units in 1941 from 61,731 units for the similar period of 1940, not including Canada.

World sales in August totaled 266,011 units, compared with 202,209 units for August, 1940 and for the eight-month period 2,994,108 units, against 2,273,369 units for the similar period of 1940.

Sales of electric ranges in August totaled 50,759 units, compared with 29,128 units in August last year, a gain of 74.3 per cent. For the eight-month period ended August sales totaled 478,868 units, compared with 287,484 units for the similar period of 1940.

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Crocker-Wheeler Net Makes Sharp Gain

In its semi-annual report, issued recently, the Crocker-Wheeler Electric Manufacturing Co. reports a net income of $278,730 for the first half of this year, equal to 95 cents a share on 290,500 shares of no-par common stock.

For the first six months of 1940 the income from operations was $10,516 after taxes and other charges. Including extraordinary charges for the most part applicable to prior years of $331,693, there was a deficit for that period of $321,177 carried to operating deficit account.

Sales for this year's period were about 13 percent less than for the entire year of 1940. Unfilled orders on hand on June 30 totaled $3,865,407, and the backlog is continuing to increase, the report states. More than 90 percent of the company's business is directed to the national defense effort.

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"House of Ideas" Opened by G.E. in Bridgeport

General Electric Co. opened for public inspection on September 28 a "House of Ideas" situated on a Bridgeport, Conn., suburban site. The fundamental idea of the "House of Ideas" is a demonstration of the fact that "big" living space and the most in living can be obtained in a relatively "small" house. Besides the many new ideas for the home-builder and homeowner offered in the planning and construction, the "House of Ideas" offers a variety of entertaining features for visitors. It is an all-electric home in action.

During the public inspection, the "House of Ideas" will tell its own story, for it is a "talking house." This is accomplished by a tricky device which makes the walls of the house itself seem to speak up to the visitors and explain its interesting features. The house will be open to visitors for a month daily from 1 P. M. to 9 P. M.

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Will Expand Capacity

American Transformer Co., Newark, N. J., has leased a one-story industrial building opposite its plant at 175 Emmett Street, which it will improve and equip at once for expansion. This addition will be used largely for handling Government contracts.

Westinghouse Files New Financing Plan

Westinghouse Electric & Manufacturing Co. has filed with the Securities and Exchange Commission a registration statement, covering 534,426 shares of common stock, $50 par value, and subscription warrants evidencing the right to purchase such shares.

Referring to recent "unprecedented expansion," the statement said that of the new capital obtained about $21,000,000 will be used to retire bank loans and "at least $25,000,000" will be expended for capital additions prior to December 31, 1942. The balance will provide working capital.

A special meeting of the stockholders of the company has been called to be held on October 29, for the purpose of considering and acting upon a proposal to increase the authorized indebtedness of the company to $50,000,000, at any one time outstanding. Subject to the authorization of such increase by the stockholders, the company contemplates issuing about $20,000,000 principal amount of unsecured debentures to provide the balance of the new capital.

The offering price of the common stock will be furnished by amendment.

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Hygrade Sylvania Lamp Life Rating Increased

Announcement has been made by the Hygrade Sylvania Corp. that the rated average life of its 100-watt fluorescent lamp has been increased from 2,000 hours to 2,500 hours, effective September 2. This change is made as a result of extensive life tests at the Salem laboratories which indicate that the previous 2,000-hour figure is much too conservative. This increase in life-rating figure, together with the recent reduction in the list price of fluorescent lamps, results in a very significant potential saving.

AN OPEN LETTER

To ROEBLING *Customers and Prospects*

Regarding Shipments . . .

In common with practically all manufacturers whose products are vital to Defense, Roebling is faced with a situation without precedent.

Despite our best efforts—the expansion of our working force—the installation of new machinery—and operation on a 24-hour basis—we find it impossible to keep up with the demand for Roebling electrical wires and cables.

We want you to know, however, that we keenly appreciate your problem. As a buyer, ourselves, we know how serious and irritating shipping delays can be at a time such as this.

Unfortunately, the pressure is increasing instead of decreasing. But we are alert to every opportunity to effect improvements. And you can rest assured that no stone will be left unturned by Roebling in its efforts to meet your needs.

JOHN A. ROEBLING'S SONS COMPANY
TRENTON, NEW JERSEY

ROEBLING 1841 1931 100th ANNIVERSARY

ROEBLING
ELECTRICAL
WIRES AND CABLES

Manufacturers Make Sales Appointments

Pacific Electric Manufacturing Corp. has announced the appointment of Myron Swendsen as sales representative in the territory served from Boise, Idaho. A graduate of the University of Utah, Mr. Swendsen has had considerable experience in utility work and for the past eight years has been engaged in engineering and sales work.

Other companies making recent sales appointments include the following:

Bristol Co. has transferred H. R. Bristol from the Chicago office to Boston with headquarters at 250 Stuart Street. J. E. Booth has been appointed to take over the territory in Chicago district formerly covered by Mr. Bristol.

Gould Storage Battery Corp., Depew, N. Y., has opened a new office at 430 Frick Building, Pittsburgh, Pa. The ever increasing volume of business in the Pittsburgh territory necessitated the establishment of this office. S. E. Gane, sales representative since 1920, will be in charge of the office. Assisting Mr. Gane will be E. J. Boyle, recently appointed sales representative.

Consolidation of Easy Washing Machine Corp.'s New England territory with that of metropolitan New York has been announced by W. Homer Reeve, sales manager. Heading up this revamped territory will be G. J. Fitzgerald, who has been associated with the Easy company in various sales capacities since 1927.

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Forms Range Division

Formation of a commercial division which will manufacture Akron electric ranges for restaurants, hotels, institutions and the marine field has been announced by John Raymond, president of the recently organized Associated Products, Inc., Akron, Ohio. William H. Sickinger has joined the company as vice-president in charge of this division. Mr. Sickinger has a broad background of experience in household and commercial electric range design and development.

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Move to Larger Quarters

Announcement has been made by Rex Rheostat Co. that it has moved to larger quarters located at 3 Foxhurst Road, Baldwin, Long Island, N. Y. The company was formerly located in New York City.

New York Metal Prices

	Sept. 30,'41 Cents per Pound	Sept. 24,'41 Cents per Pound
Copper electrolytic	12.00*	12.00*
Lead, A. S. & R. Price	5.85	5.85
Antimony	14.00	14.00
Nickel, Ingot	35.00	35.00
Zinc Spots	7.64	7.64
Tin, Straits	52.00	52.00
Aluminum, 99 percent	17.00	17.00

* Delivery Connecticut Valley.

are you throwing away DOLLARS in DUST?

FOUNDRY SHAKE-OUTS

Buell Collectors are widely used to collect dust in shake-out rooms, to prevent dust escaping from tumbling barrels, and to reclaim dust from the cleaning of molding sand.

MACHINING OPERATIONS

In machining operations such as grinding, buffing, milling, planing, etc., Buell Dust Collectors, applied to exhaust hood systems, have an outstanding record of high efficiency.

WASTE HEAT GASES

Contamination of product in dryers utilizing dust laden waste heat gases is eliminated by the use of Buell cyclones, which have been found to have higher efficiency and lower power consumption than collectors which they replaced.

FOOD PROCESSING

Buell has developed collectors of special design and notable efficiency for many food products, such as powdered coffee, powdered milk, etc. Fabrication of stainless steel and hinged construction for easy cleaning meet all pure food law requirements.

CHEMICAL PRODUCTION

Buell Dust Collectors have proved highly efficient in removing contaminating flue dust from gases (such as sulphur dioxide in sulphuric acid manufacture), and in salvaging valuable dust (as in spray drying of magnesium hydrate) normally lost in exhaust.

THESE ARE JUST A FEW of the many applications in which Buell (van Tongeren) Dust Collectors are successfully serving such leaders of industry as Detroit Edison Co., Dow Chemical Co., Ford Motor Co., Lone Star Cement Corp., Nestle's Milk Products, Inc., and many others. The Buell Dust Technician in your territory will be glad to discuss the application of Buell (van Tongeren) Dust Collectors to your business.

Write for a copy of 24-page "Bulletin E-10, Dust in Industry"

BUELL ENGINEERING CO., Inc.

Suite 5000, 75 Pearl Street, New York

Nation-wide service through offices of either Buell Engineering Co. or B. F. Sturtevant Co.

buell

DUST COLLECTORS

Crapo
GALVANIZED STEEL
STRAND

Combines All 4

1—HIGH STRENGTH
2—RUGGEDNESS
3—LONG LIFE
4—ECONOMY

All the inherent strength and ruggedness that steel alone provides are combined with long life and definite economies in Crapo Galvanized Steel Strand. Each size and grade developes the full tensile strength of the steel in its complete cross-section. The heavy, ductile, tightly-bonded zinc coating—applied by the famous Crapo Galvanizing Process—affords lasting protection against corrosion, extends the life of the strand beyond the normal period for replacement.

Low first cost, workability in the field, consistent, trouble-free performance and low maintenance expense characterize the service history of this time-tested product. There is a size and grade of Crapo Galvanized Steel Strand for every practical need. Consult the distributor of Crapo Galvanized Products near you or write direct for further information!

INDIANA
STEEL & WIRE CO.
MUNCIE, INDIANA

Field Reports on Business

Indications of a halt in the upward movement in business have appeared. With few exceptions, recent substantial increases have been confined to defense industries. Construction of plant capacity is proceeding steadily, but at a slower pace. Retail sales soared this week on the eve of the new excise taxes.

NEW ENGLAND

Substation expansion and modernization is progressing in a number of localities where a high rate of industrial activity prevails as a result of national defense contracts. Recent equipment purchases by the Brockton Edison Co. include a 300-kva. network vault unit and two unit substations aggregating 2,500 kva. Mansfield (Mass.) Electric Light Department is modernizing a substation; electric cable buying is active.

Last week's government orders included cable, wire, wiring supplies, numerous conduit orders, panelboard supplies and radio tubes. American Brass sold $58,511 worth of flexible cable conduit and Simplex Wire & Cable received an order for $70,458 worth. Among outstanding large orders placed by government departments in this area last week are noted fuses, Waterbury Clock Co., $970,000; bomb signals, National Fireworks Co., West Hanover, Mass., $113,760; pumping units, Yale & Towne Manufacturing Co., $50,995.

Street-lighting equipment sales are active.

If delivery conditions allow, there will be a record-breaking holiday demand for electrical appliances and radio sets in upper New York and New England, according to a recent General Electric conference at Boston attended by representatives of seven states under the auspices of the appliance and merchandising department.

An eight-story science building for the Hartford, Conn., Retreat will be erected immediately and equipped with air-conditioning and fluorescent lighting throughout. R. H. White Co., Boston department store, is installing 1,500 40-watt fluorescent lighting units. Connecticut Light & Power energy sales for August reached a record level, being 6.7 percent above the company's previous all-time high.

CHICAGO

Dislocations due to the pressing needs of the defense program continue to cloud the outlook for civilian industries dependent on strategic materials. Intensified efforts are being made to spread sub-contracting more widely to offset material losses caused by priority rulings. However, losses through unemployment and reduced buying power of consumer goods are expected, at least temporarily, during the next few months before any adjustments can be effected.

Industrial activity continues at peak levels, but further expansion is limited by plant capacity and shortages of supplies. Construction of additional plant facilities is proceeding steadily, but not as rapidly as earlier in the year. Retail trade shows signs of leveling off somewhat although, the sales volume is still 15 to 20 percent ahead of last year. Electrical appliances are moving in good volume, but shortages of a number of items are becoming apparent. Wholesalers report heavy demand for wiring supplies. Industrial lighting equipment is very much in demand and manufacturers are selling almost exclusively on priorities.

Defense contracts for electrical equipment placed in this area last week included: American Steel & Wire Co., insulated cable, $38,249; Small Motors, Inc., dynamotors, $109,005; Graybar Electric Co., portable tools, $30,049, and cord circuit repeaters, $42,000; American Automatic Electric Sales Co., handsets, switchboards, and telephone apparatus, $135,253; Automatic Transportation Co., electric trucks, $10,470; Allis-Chalmers Manufacturing Co., circuit breakers, $20,486, transformers, $48,058; Nehring Electrical Works, cable, $34,752.

NEW YORK

Business activity, after rising steadily for the past year and a half, is beginning to show indications of stability. Evidently the stimulation experienced in some industries by the defense program is now being offset by the restrictions in other industries.

Industrial lighting and home lighting will be aggressively promoted by utility companies during the coming months. It is believed that curtailment of sales of electrical appliances, caused by defense priority measures, will be reflected in a slower rate of gain in residential power consumption next year. Efforts to obtain substitute materials, repairs to present equipment and the marketing of second-hand equipment will constitute part of the industry's campaign to offset this possible reduction.

Retail trade in luxuries and other consumer items, after tapering off slightly in recent weeks, moved sharply upward this week, as consumers sought to forestall the excise taxes which became effective October 1. Local retailers expressed the opinion that the current wave of buying will probably be followed by a decline, since buyers are not likely to enter the market for these products for some time.

PACIFIC COAST

Doubt over replacing stocks, some confusion over conflicting priorities and retail uncertainty because of closed shop department store and hotel strikes in the Bay area are reflected in growing caution, despite prevailing high volume of electrical business in all branches. San Francisco is also seriously concerned because the seven-times-beaten proposal to establish a municipal electric system will again be voted upon November 4.

Machinery and line material buying for major plants cover sixteen 2,500-kva. transformers for Shasta, for which Allis-Chalmers at $279,700 was low bidder; fifteen 3,200-amp., 1,500-volt bus structures for Shasta, for which G.E. was low at $420,540; copper transmission and distribution conductors totaling $348,674 for the Bonneville-Grand Coulee system, and $55,000 pumping motors for Pearl Harbor.

REA construction is showing a seasonal tapering off with recent allotments of $80,000 for 60 miles serving 167 members in Lake County, central California, and $15,000, Umatilla Coast section, Oregon.

A quick Coast survey reveals definite shortages of all insulated wires and cables and certain wiring devices, especially twist-lock in all makes. Recent heavy receivals have improved the condulet situation and all conduit, both rigid and flexible, is in fair shape.

LOTS OF PUSH AND PULL FOR THEIR SIZE—

INTERNATIONAL T-6 and T-9 TracTracTors with Distillate or Gasoline Engines

GOOD THINGS come in pairs when you're in the market for medium-sized crawler tractors with gasoline engines. These International TracTracTors give you plenty of push and pull for their size. Both the T-6 and T-9 *develop more drawbar pull than any other tractors in their size and power range.*

The T-6 and T-9 have the same dimensions as the popular TD-6 and TD-9 DIESELS. The T-6 has a 4-cylinder valve-in-head engine, with bore and stroke 3⅞ x 5¼ in. It has five forward speeds, from 1.5 m.p.h. to well over 5 m.p.h. It develops 32.9 drawbar h.p. on gasoline at 1,450 engine r.p.m. and 7,650 lbs. drawbar pull. The T-9 develops over 40 drawbar h.p. on gasoline at 1,400 engine r.p.m. and over 9,500 lbs. drawbar pull. Bore and stroke: 4.4 x 5.5 in. Five forward speeds, from 1.5 m.p.h. to well over 5 m.p.h.

Both tractors have all the time and money-saving features of modern TracTracTor design. For example, there's Tocco-hardening — which Harvester pioneered — in crankshafts and track rollers. The specially designed combustion chamber, providing smoother operation, longer engine life, and remarkable fuel economy, is another feature you'll appreciate.

See the nearest International Industrial Power dealer or Company branch for more information about these crawlers.

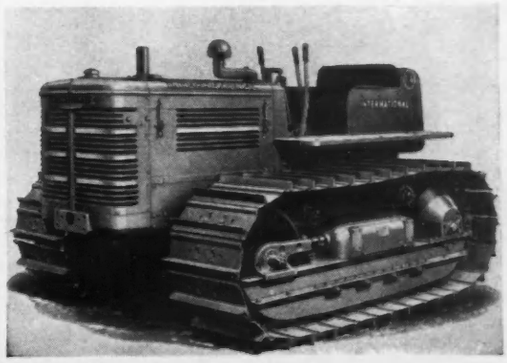
INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue Chicago, Illinois

TYPICAL EQUIPMENT THE T-9 OPERATES

Bulldozers—6½ to 8 ft. • Bullgraders—8½ to 10 ft. • 2-wheel scrapers—3 to 4 yds. • 4-wheel scrapers—4 to 5 yds. • Rollover scrapers—1 to 1¾ yds. • Blade graders—8 to 10 ft. • Front-end shovel—¾ yd. • Cranes—2 ton @ 8-ft. radius • Towing winches—12,500 lbs. @ 100 ft.p.m. • Oil field winches—35,000 lbs. @ 35 ft.p.m. • Snow plows—8 to 9-ft. cut • Terracers—8 to 10 ft. • Pipe booms, lift @ 8-ft. overhang—5,500 lbs. • Small logging arches and fire-line plows.

TYPICAL EQUIPMENT THE T-6 OPERATES

Bulldozers—6 to 7 ft. • Bullgraders—7½ to 8½ ft. • 2-wheel scrapers—2½ to 3½ yds. • Rollover scrapers—½ to 1 yd. • Blade graders—7 to 8 ft. • Front-end shovel—½ yd. • Cranes—1 ton @ 8-ft. radius • Towing winches—10,000 lbs. @ 100 ft.p.m. • Oil field winches—25,000 lbs. @ 40 ft.p.m. • Snow plows—8-ft. cut • Terracers (light)—8 ft. • Small logging arches and fire-line plows.



INTERNATIONAL Industrial Power

NEWS ABOUT PEOPLE

Philadelphia Electric Makes New Appointments

M. L. Roach has been appointed electric superintendent (acting), Delaware division, Philadelphia Electric Company, during the absence of J. W. Buxton, who was called into military service and M. S. Jolley has been appointed electric superintendent, Main Line division, during the absence of L. G. Witmer, called for military service. W. F. Roth has been appointed electric superintendent, eastern division, to succeed G. H. Knouse, transferred to the engineering division, transmission and distribution department, as senior engineer. R. L. Cole has been transferred to the engineering staff of the general superintendent's office, transmission and distribution department. He was formerly appliance service superintendent in Norristown.

W. R. Ross has been named superintendent of the underground section of the Philadelphia division. He has served as designer of switchboard construction, assistant electrical engineer, assistant engineer, and superintendent of overhead-underground lines in Philadelphia. Chester W. Iles has been appointed electric superintendent (acting), Schuylkill division, to succeed the late R. G. Stafford.

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▶ HARRY L. BRADLEY, formerly vice-president and treasurer, is now executive vice-president of Allen-Bradley Co., Milwaukee, Wis.

▶ L. F. SEYBOLD, vice-president of the Wisconsin Electric Power Co. and president of the Wisconsin Utilities Association, has been named to represent public utilities on a recently organized Wisconsin committee to help promote the sale of defense bonds.

▶ J. S. KNOWLSON, president and chairman of the board of Stewart-Warner Corp., has been appointed deputy director of priorities in charge of operations by Donald M. Nelson. Mr. Knowlson replaces Thomas B. McCabe, who goes with Edward R. Stettinius, Jr., former priorities chief, into the lend-lease administration. Graduated from Cornell in 1905, Mr. Knowlson was for four years associated with General Electric Co. as an electrical engineer. He was president of the Speedway Manufacturing Co. before joining the Stewart Warner Corp.

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J. W. Alexander Heads Rocky Mountain Group

J. W. Alexander, who was elected president of the Rocky Mountain Electrical League at the recent convention

at Estes Park, Colo. (ELECTRICAL WORLD, September 27, page 9), has been engaged in the public utility business for 22 years in the states of Colorado, New Mexico and Wyoming.

Beginning as a meter man, he worked through the various departments of the several companies with which he was identified, and at the present time he is president and manager of the Rawlins Electric Co., Rawlins, Wyo.

Mr. Alexander was born in Colorado and was educated in the public schools of Durango, Colo. He attended college at Boulder, Colo., and the College of Engineering, Nancy, France, during the World War. He is a member of the Edison Electric Institute and of the Illuminating Engineering Society.

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▶ ROBERT W. BECK, manager of the Grays Harbor Public Utility District, Aberdeen, Wash., since the district acquired its power system from the Grays Harbor Power & Light Co. last year, has resigned to assume active charge of his engineering firm in Seattle.

▶ CHARLES W. MCCALLUM, formerly connected with the Arkansas Power & Light Co. as manager of its properties at Parkin, has been named manager of the Augusta, Ark., municipal light and power system, succeeding Olan Rowe, resigned.

▶ MARVIN BELANGIE of Butte, Mont., has been appointed as district manager at Cœur d'Alene of the Montana Power Co., succeeding the late S. E. Peel. Mr. Belangie has been connected with the power company since his graduation from the University of Montana.

▶ MALCOLM T. BARD has been appointed to the newly created position of manager commercial refrigeration sales of the Airtemp Division of Chrysler Corp. Mr. Bard was formerly sales manager of the commercial refrigeration department of the Norge Division of Borg-Warner Corp. He had been with Norge since 1937 and prior to that with General Electric Co., where, since 1929, he assisted in the organization of that company's commercial sales activity.

▶ WILLIAM D. SHANNON, formerly northwest manager of the Stone & Webster Engineering Corp. in Seattle, has been named district manager for the recently opened district priorities division office of the OPM, with headquarters in Seattle. Mr. Shannon, through his connection with Stone &

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cable protection provided by

ORANGEBURG CONDUITS

is contributing to the continuity of light and power service so requisite to the construction of merchant and naval vessels.

ORANGEBURG **Standard** for installation *with* concrete encasement
NOCRETE for installation *without* concrete encasement

Photograph by Cushing

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QUIT STABBING POLES
● Use the new Multipoint Cant Hook. Its 6 points, ¼ in. x ½ in. in size, hold better than a single long point. Leave no deep stab holes where water collects and rot starts—do not damage the creosote treatment. The Multipoint Cant Hook grips more securely even the smallest diameter poles which are so difficult to handle with the standard single point hook—spreads strain over wider area—is self-releasing. Furnished in 3 sizes for handling poles up to 22 inches in diameter. Multipoint speeds up pole handling in the yard—eliminates damage—saves time and money. Made by the American Fork & Hoe Company, Cleveland, Ohio.
STURDETOOLS
a TRUE TEMPER PRODUCT
STURDETOOLS
MULTIPOINT CANT HOOK
6 points ¼"x½" in size grip the pole securely but leave no deep hole to encourage rot and decay.
Furnished in small, medium and large sizes for handling poles up to 22" in diameter. Prices and complete description on request.
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Branches and Warehouses with Complete Stocks in Principal Cities of the United States

Webster, was identified with the construction of many of the power plants serving the Puget Sound area. He also had charge of construction of the first trunk transmission lines over the Cascades in Washington and the Sierra Nevadas in California.

▶ GEORGE A. JOHNS has been elected president of the American Insulator Corp., New Freedom, Pa., to succeed William S. Grove, resigned. Mr. Johns has been associated with the company since 1926 and has been vice-president and sales manager.

▶ R. N. MOORE of Canton, Ohio, has been named superintendent of the Lima district of the Ohio Power Co., to succeed the late L. A. Wagoner, who was killed in an automobile accident. Mr. Moore was commercial department manager at Lima prior to his transfer to a similar position in Canton last July.

▶ J. O. HENKEL, who was recently elected a vice-president of the Alabama Power Co., has been appointed director of personnel and safety. J. O. SPEED has been made manager of safety.

▶ FREDERICK G. RUSSELL, traffic manager of Landers, Frary & Clark, was retired recently after completing seventy years of continuous service with the company. During his period of service, Mr. Russell watched the company grow from one small factory manufacturing hardware and cutlery, to a large plant manufacturing a variety of products and employing about 3,000 people.

▶ FRANK WALSH, formerly northwest division manager, Puget Sound Power & Light Co., Bellingham, Wash., has been transferred to the managership of the central division of the company, with headquarters at Seattle. He has been with the company since 1912.

▶ BASCOM B. RIGGS, formerly manager of the Western Grove district for the Arkansas Power & Light Co., has been named rural lines supervisor at Harrison and SAMUEL COVINGTON of the Harrison service department, has been made manager of the Western Grove district.

▶ W. L. SCHNEIDER has been appointed to the position of vice-president of sales of the Falk Corp., Milwaukee, Wis. T. F. SCANNELL has been made sales manager and J. B. KELLEY assistant sales manager. Mr. Schneider started at the Falk Corp. as a sales estimator. He has held successive positions of sales engineer, assistant sales manager and sales manager. He is active in the American Gear Manufacturers Association. While fulfilling his new duties as a vice-president, Mr. Schneider will continue in the supervisory capacity as director of sales. Mr. Scannell joined the Falk corporation in 1928 as St. Louis representative, later becoming district manager of the southwest territory. Last year he became assistant to the sales manager in Milwaukee. He has also been active in the work of the American Gear Manufacturers Association. Mr. Kelley has been with the Falk organization since 1927, serving first as an apprentice and later as estimator, salesman, district manager in Cincinnati, and in recent years has been in charge of the corporation's flexible coupling business.

▶ R. H. OLSON, New York district manager of sales since 1929, has recently been appointed Eastern sales manager of Electric Machinery Manufacturing Co., Minneapolis, Miss. Mr. Olson has been associated with the organization for 25 years, having been previously in charge of Minneapolis and St. Louis district sales.

▶ H. L. LOGAN, managing engineer controlens division of the Holophane Co., Inc., New York, has been appointed to serve as a consultant to the industrial visual commission of the public health bureau of the American Optometric Association. Mr. Logan has also been elected secretary of the illumination group of the New York section of the American Institute of Electrical Engineers.

▶ GLENN GUNDELL, who has directed the advertising and sales promotion activities of the General Electric air conditioning and commercial refrigeration department, at Bloomfield, N. J., for the past five years, has relinquished those duties to become associated with the advertising division of the General Electric appliance and merchandise department, at Bridgeport, Conn. ERNEST MACAULAY, a member of the G.E. appliance and merchandise department since 1929, and most recently advertising supervisor for electric clocks at Bridgeport, has been appointed manager of advertising and sales promotion for the air conditioning and commercial refrigeration department, Bloomfield.

▶ LARRY E. GUBB, formerly executive vice-president, has been elected chairman of the board of Philco Corp., Philadelphia, Pa. Several other promotions have been announced. JOHN BALLANTYNE, formerly treasurer, has been elected vice-president in charge of operations; THOMAS A. KENNALLY, formerly general sales manager, has been named vice-president in charge of sales; W. R. WILSON, controller, succeeded Mr. Ballantyne as treasurer, and JAMES H. CARMINE, formerly assistant general sales manager, became general sales manager. James T. Buckley, who has been president of Philco since 1939, will continue in that office. Mr. Gubb has been connected with Philco since 1920.

OBITUARY

William LeRoy Emmet

William LeRoy Emmet, consulting engineer of the General Electric Co., who was known for his contributions to the fields of power generation and ship propulsion, died September 26 at Erie, Pa., at the home of his nephew, H. L. R. Emmet, manager of General Electric's works there. Mr. Emmet had been ailing from a heart condition. He was 82 years old.

As early as 1909 Mr. Emmet had pointed out that electric ship propulsion was feasible, economical and practical. He did significant work in developing the steam turbine from the embryonic to the practical stage and worked out the Emmet mercury-vapor

process of power generation. A total of 122 patents were issued in his name.

Mr. Emmet was born in Pelham, N. Y., and was graduated from the U. S. Naval Academy. He first became associated with electrical work in 1887 when he entered the employ of the Sprague Electric Railway & Motor Co. He later went with the Buffalo Railway Co. as electrical engineer, and soon afterward joined the Edison General Electric Co. in the Chicago district. He went to Schenectady in 1892 when the Thomson Houston Co. joined with the Edison General Electric Co. to form the General Electric Co.

Mr. Emmet's initiative, ideas and experimentation played a great part in the adoption of the steam turbine for central station power generation and largely through his efforts, the Navy Department in 1913 was induced to allow an installation of turbine-electric drive in the collier *Jupiter*. The success of this installation led to the adoption of electric drive for subsequent large U. S. Navy warships.

Prior to his achievements in the steam turbine field, he attained prominence through his work in encouraging the use of alternating current and a number of inventions making possible its practical use stand to his credit. He made significant contributions in the field of electrical insulations and also invented several types of transformers.

Mr. Emmet was a past-vice-president of the American Institute of Electrical Engineers and was awarded the Edison Medal by that society in 1919. In addition he received the gold medal of the American Society of Mechanical Engineers, the Elliott Cresson medal and two years ago the David W. Taylor medal of the Society of Naval Architects and Marine Engineers.

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▶ WILLIAM HOGG, for many years associated with the Hydro-Electric Power Commission of Ontario, died in Toronto on August 27, after a short illness. He was 71 years old. Many power developments, beginning with the Ontario Power Co. some years ago, the Queenston development and several power houses since then from Ear Falls in the far Northwest to the one at Big Eddy in Iuskoka, which is still under construction, owe part of their existence to his efforts.

▶ PETER STEWART, assistant manager of operations at Worcester, Mass., for the American Steel & Wire Co., died suddenly on September 10 at his home in Boylston, Mass. Born in Glasgow, Scotland, in 1875, Mr. Stewart came to this country at an early age. With the exception of one year spent in Philadelphia, Mr. Stewart's entire business experience had been in Worcester. Since 1900 he had been associated with the American Steel & Wire Co.

▶ BRIG.-GEN. CHARLES H. MITCHELL, recently retired as dean of the faculty of applied science and engineering at the University of Toronto, died at his home in that city on August 26, after a long illness. He was 69 years old. General Mitchell, widely known in Canada as a hydraulic engineer, had a distinguished military career. He was active in many water-power developments in Canada and at one time traveled in Europe, studying such developments on the Continent. He was a consulting engineer in Toronto from 1906 to 1914. He was appointed dean of science at Toronto University in 1919 and in the subsequent years he served on various government boards and commissions concerned with water-power development. In 1924 he was Canadian appointee to a joint board of Canadian and United States engineers to study and report on the St. Lawrence seaway project for navigation and power.

You cut out waste motion when you use the Fargo Connector It's built as one unit, free from loose parts, and *always threaded.* No time lost starting a nut, no chance of cross threading.

Re-use the Fargo Connector, again and again. With its rugged Everdur body and Duronze bolt, the Fargo Connector "grips like a vise" every time.

Made by
FARGO MFG. CO.
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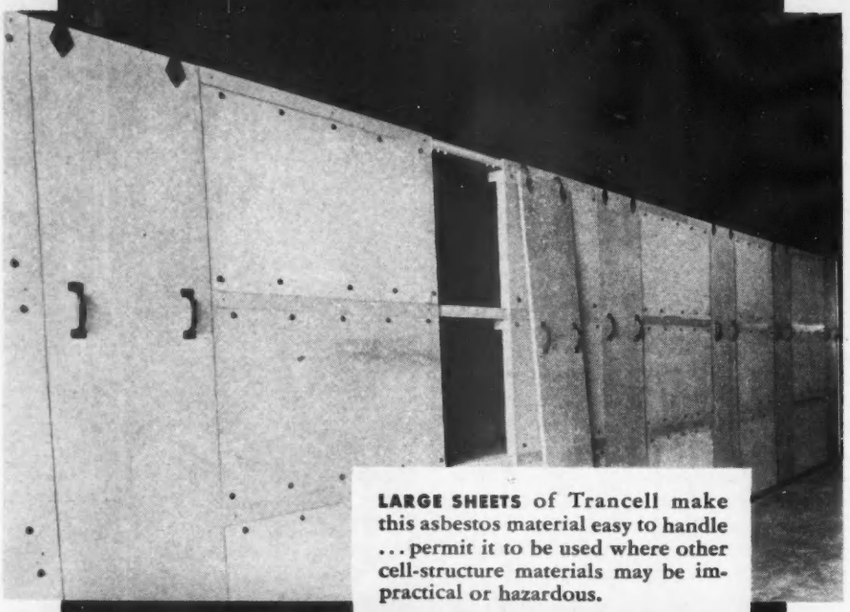
LINE MATERIAL CO.
MILWAUKEE, WIS.

SAVE TIME AND MONEY on STATION MODERNIZATION...



LARGE SHEETS of Trancell make this asbestos material easy to handle ... permit it to be used where other cell-structure materials may be impractical or hazardous.

Build cell structures and housings for existing equipment with J-M TRANCELL...

You save on first cost—Trancell is a prefabricated asbestos sheet material that provides unusually efficient, economical cell structures of all types. It costs considerably less than metal enclosures and no more than other less satisfactory materials that might be used.

You save on installation—Supplied in large, easily handled, ready-to-install units, Trancell can be used where concrete or other cell-structure materials are impractical. Using ordinary tools, any handy man can do a fast, neat job. Where balconies or upper floors must be used for housing equipment, Trancell's light weight eliminates the problem of heavy floor loads.

You save on final cost—Trancell assures continued low maintenance. Being non-metallic, it cannot rust ... ends condensation troubles. Shutdowns for cleaning or painting are seldom, if ever, necessary, for the natural finish of Trancell stays neat in service. Because Trancell is completely fireproof, it confines oil fires to the cells of origin. And its low conductivity protects adjacent equipment against transmitted heat.

Why not send for full details? At the same time, ask for information on J-M Trancell Doors, the doors that so many utilities are using to eliminate warpage problems. Johns-Manville, 22 East 40th Street, New York, N. Y.

JM

Johns-Manville TRANCELL

an asbestos product ... for better cell structures and doors

Priorities Control Methods for Power Utilities

[*Continued from page 58*]

everything possible is done to take care of essential needs through specific allocation of these vital materials.

With the defense program constantly increasing, it is inevitable that the supply of other materials will become inadequate to satisfy all defense and civilian requirements, and that the allocation procedure is therefore likely to be applied to an increasing list of materials. As you all know, there will be endless problems in devising an effective system of priorities and allocation, and in the operation of industry under it. We shall do everything possible to make the system function effectively regardless of the difficulties. But in order that they should be really successful the utilities must do their part. You know what is required to reduce material requirements to a minimum, and, better than I do, you know what can be done to meet the exigencies of the situation. But, in summary, the following should be mentioned:

Specifically

1. Order only the minimum of equipment and materials necessary to meet your requirements.

2. Eliminate at once business promotion activities, including the inducements ordinarily given to customers to purchase heavy appliances.

3. Eliminate all frills in construction—include only the essentials of meeting service requirements.

4. Defer all major rehabilitation wherever possible. Repair rather than replace equipment when possible. Careful attention should be given to obtaining the maximum salvage.

5. Apply your ingenuity to the development of substitutes for critical materials. Find out from your supplier what items are causing difficulties and do what you can to eliminate them or find a satisfactory substitute. In particular, substitute wood for steel except where steel is essential.

In conclusion, I want you to know that we are organizing in Washington a staff which should know the problems of the industry. This staff is being recruited directly from the operating systems, including those publicly and privately owned. Regard-

PORTABLE MEGOHMMETER *with a* Resistance Range *of* TWENTY MILLION TO ONE

TO MEET the need for a portable, d-c operated megohmmeter similar to the older Type 487-A Megohmmeter developed some time ago, G-R announces the Type 729-A instrument. This meter retains the basic circuit features of the a-c meter, but incorporates a number of improvements which increase its stability, its range and its compactness. This meter is particularly suited to measurements of moisture content of various materials by the conductivity method where extremely wide resistance ranges must be covered.

FEATURES

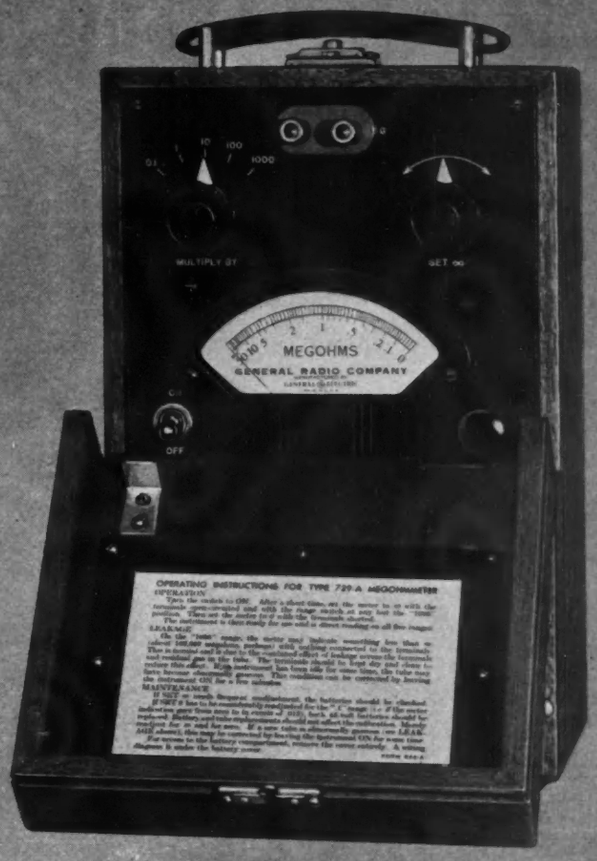
- **WIDE RANGE**—2,000 ohms to 50,000 megohms, in 5 overlapping steps.
- **IMPROVED STABILITY**—highest-value resistances standard sealed in vacuum and coated to prevent surface leakage; greatly increases stability on the high range.
- **COMPACT**—weighs only 8¾ pounds; dimensions: 11 x 6⅝ x 5⅞ inches.
- **IMPROVED CIRCUIT**—battery placed in measuring loop without any controlling resistances; low-resistance limit determined by internal resistance of battery.
- **GOOD ACCURACY**—within 2% from 30,000 to 300,000 ohms; within 5% from 300,000 ohms to 3,000 megohms; decreases to about 10% at 10,000 megohms.
- **CONVENIENCES**—zero adjustment automatically corrects sensitivity to insure correct readings throughout life of batteries; instrument is automatically turned off when cover is closed.
- **LOW VOLTAGE ON UNKNOWN**—does not exceed 22½ volts and varies with meter reading.

TYPE 729-A MEGOHMMETER (complete with tube and batteries)..$85.00

WRITE FOR BULLETIN 742 FOR COMPLETE INFORMATION

GENERAL RADIO CO.

CAMBRIDGE, MASSACHUSETTS



Standard direct-reading ohmmeter scale calibration with center scale values of .1, 1, 10, 100 and 1,000 megohms; except at the extreme ends of the range, only the center decade of the scale need be used.

1,000-megohm standard resistance sealed-in vacuum and coated to prevent surface leakage.

ON THE NIGHT OF THE 17TH A BOMB STRUCK THE SWITCHGEAR CUBICLE

[A REPORT FROM ENGLAND]

Our London Office reports — "On the 17th of [redacted] at the [redacted] Generating Station a fire was started by a bomb which struck "C" Section of the switchgear cubicles. It shorted a cable, causing switch to explode, blowing off the steel roof.

"Burning oil from this section was thrown into adjoining Sections — "B" and "D", also into No. 3 Transformer bay, and all over the ceiling of the main building, causing four fires at once!

"Automatic LUX System operated in these four sections, opening the valves and releasing the fourteen 50-lb. carbon dioxide cylinders. In 3 or 4 minutes all four fires were extinguished.

"The ceiling still blazed. A LUX Wheeled Unit was rushed up and the operator snuffed out the remaining fire."

The point is simply this.—The [redacted] Generating Station was ready when an emergency struck it. A LUX installation, made in peacetime, played its part brilliantly in time of war!

Prepare with LUX Built-in Extinguishing Systems and LUX portables. Then you're ready for fire—whenever it strikes!

Walter Kidde & Company
INCORPORATED
1028 West Street, Bloomfield, N. J.

less of the pressure of work, we are available at all times to consult with you concerning your problems. At the same time, we are confident that you will find solutions independently for every problem which falls within the scope of your responsibility and that the power systems will not fail in coming through with the best performance when circumstances are most difficult.

Allocations to Head Off Priorities Scrambles

[*Continued from page 72*]

running order and in more than standby condition."

Today you cannot translate that language into tons of copper. But Nelson expects to make this translation when the over-all requirements survey is completed.

Then there will be this picture. Against total supply first will be assessed the military and essential civilian requirements. The remainder will be available for other civilian operations, to be split up among competing uses through curtailment programs developed by the Civilian Supply Division of OPM and approved by both OPM and SPAB.

Not necessarily, however, is civilian industry to be given only the scraps. SPAB also is undertaking to attack the supply problem from the other end, to increase available materials which cannot be expanded enough. Chief beneficiary of results in this direction will be civilian industry.

•

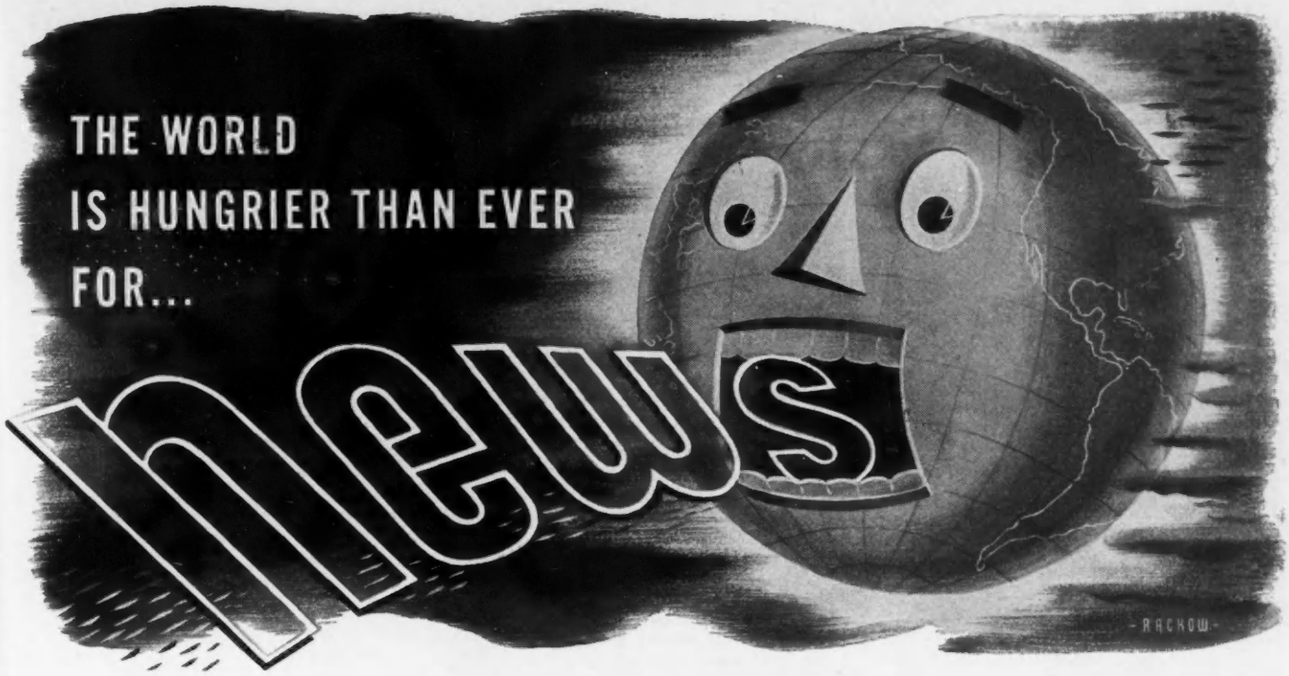
Refuses Rate Cut Appeal

Indiana Public Service Commission has refused to permit fifteen downtown firms to apply to the Indianapolis Power & Light Co. for lower rates. The commercial firms contended that they use large quantities of electricity and hence are entitled to the same rates as those paid by the industrial firms.

•

Awards Contract to G.E.

City Council, Newton, Kan., has awarded a contract to General Electric Co. at $14,774 for electric switching equipment and accessories for installation in waterworks pumping station. Black & Veatch, Kansas City, Mo., are consulting engineers.

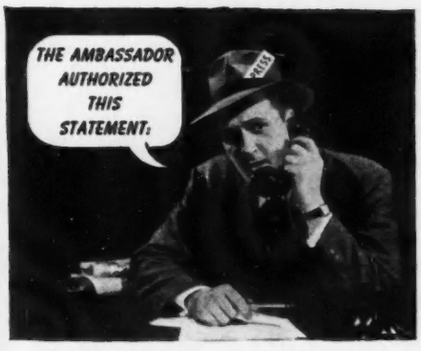


How this appetite for news is fed

What happened in Europe today? What did Congress do? Who won the golf title? And, nearer home, will it rain this week-end?

We want fast answers—and we get them through newspaper, newsreel and newscast. Do you know that these purveyors of news gather it largely on equipment produced by one organization?

* * *



The newspaper reporter's right arm is the telephone —made by Western Electric

Using the long arm of the telephone, the reporter can reach out to thousands of inaccessible spots, scoop up the news and bring it to his own desk. When he is in the field, telephones everywhere put him in instant touch with his paper.

News while it's fresh is flashed over Western Electric Teletype machines

The great press associations send out thousands of words every day to papers all over the country. These stories go by Teletype machines which make for speed and accuracy. And they travel over telephone wires—another Western Electric product.

Western Electric made the first commercial telephoto equipment

Many newspapers publish photographs which come over the telephone wires—and by means of sending and receiving apparatus which Western Electric made. Here illustrated is an operator about to transmit a picture to a group of newspapers.

Many newsreels are recorded and reproduced by Western Electric Sound System

The sound newsreel and, indeed, the talking picture itself were made possible by the pioneering work of Bell Telephone Laboratories and Western Electric.

Most radio news travels over Western Electric telephone wires

Many radio stations broadcast over Western Electric apparatus. Moreover, network programs come to your local station over telephone lines and through control centers equipped by Western Electric.

* * *

Though it plays these varied parts in your daily life, this Company is of greatest importance to you in its primary role—that of source of supply to the Bell System. As such, it is the telephone users' assurance of equipment high in quality, low in cost, dependable in operation.

Western Electric

. . . is back of your Bell Telephone service

"Trouble Ahead" → FLASHES THIS NO. 1 TROUBLE SHOOTER at the first sign of service interruption

CHECK

Autocall

POWER PLANT SUPERVISORY SYSTEM

Constant supervision of major operating equipment is vital to the successful operation and maintenance of any power plant. It is for this very reason that expert operators are turning to the AUTOCALL POWER PLANT SUPERVISORY SYSTEM. They know from experience, that it provides freedom from costly service interruption . . . safeguards the continuity of the service you are rendering . . . keeps your power plant costs at a minimum.

THE AUTOCALL CO.
413 Park Ave. SHELBY, OHIO

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A McGRAW-HILL PUBLICATION
READERSHIP

● Only McGraw-Hill papers carry the TESTED READERSHIP symbol reproduced above. It is the symbol of a program of editorial research which, through personal calls on readers by trained interviewers, picks to pieces issue after issue of Electrical World, and evaluates, in terms of reader interest, every editorial item in the issue.

● TO READERS, this means *extra* value in every issue, because our editors know what *you* are interested in, what type of material is of greatest help to you.

● TO ADVERTISERS, "Tested Readership" is assurance that Electrical World serves a vitally interested body of readers whose needs and interests the editors know and serve specifically.

Sales Opportunities

DAYTON, OHIO—Dayton Power & Light Co. plans new indoor-type power substation on Gettysburg Avenue, where site has been selected. Work is scheduled to begin soon. Transmission lines will be extended to new location for power supply for station.

MONTGOMERY, ALA.—Alabama Electric Cooperative, Inc., Montgomery, has plans maturing for new steam-electric generating plant in vicinity of city, to be equipped for initial capacity of 12,500-kw. It will be used for power supply for group of 10 cooperative electric distribution organizations, and transmission lines will be constructed to different points for this service, totaling about 380 miles in all; terminal power substations will be built for line connections. Seven of the distribution cooperatives are located in Alabama and remainder in Northern part of Florida. Entire project will cost about $2,500,000 and financing in that amount has been arranged through federal aid.

PHOENIX, ARIZ.—Bureau of Reclamation, Denver, Colo., receives bids until October 17 for construction of three transmission lines in Arizona, comprising a 115,000-volt, three-phase, single-circuit line from Phoenix to Tucson, about 123.5 miles; from Parker Dam hydroelectric power station to pumping station at Gila, to operate at 161,000 volts, about 117 miles; and a 161,000-volt, three-phase, single-circuit line from last noted point at Gila to Drop No. 4 hydroelectric power plant of All-American canal system, approximately 50 miles (Specifications 993).

LONG BEACH, CALIF.—Douglas Aircraft Co., Inc., 3000 Ocean Park Boulevard, Santa Monica, Calif., manufacturer of large military and other type airplanes, plans installation of motors and controls, switchgear, transformers and accessories, fluorescent lighting system, conveyors, electric hoists and other equipment in new additions to branch plant at Long Beach, where a number of large one-story buildings will be erected, designed to double present capacity. Cost estimated about $12,620,000. Fund in that amount will be secured through Defense Plant Corporation, Washington, D. C., a federal agency, for project. Edward C. and Ellis W. Taylor, 803 West Third Street, Los Angeles, Calif., are architect and engineer.

ALBERT LEA, MINN.—Freeborn-Mower Co-operative Light & Power Association, Albert Lea, L. A. Stensrud, secretary, has approved plans for new outdoor type power substation on local site, and will begin work soon. Transmission lines will be extended to new location for power supply. United Engineering Service, 1406 West Lake Street, Minneapolis, Minn., is consulting engineer.

PORT ARTHUR, TEX.—Gulf States Utilities Co., Port Arthur, will furnish power supply for new local steel mill of Texas Steel Co., Fort Worth, Tex., which has acquired tract of about 250 acres of land near city limits, with option on adjoining property totaling over 1,100 acres for future expansion. Transmission line will be constructed to plant site, where terminal power substation will be built. Steel company will install motor-generator sets, heavy-duty motors and controls, complete power substation equipment, duct lines, industrial lighting system, electric hoists and cranes, conveyors and other equip-

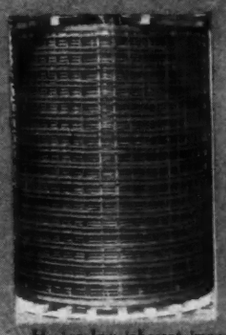
Pennsylvania FURNACE TRANSFORMERS

..are successfully meeting today's peak demands!

Industry today is working at top capacity. The modern large furnace transformer is called upon to successfully meet this peak demand.

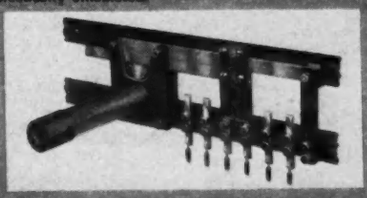
The success of this type of transformer depends upon many special conditions (involving overloads, short circuits, balancing of stresses, distribution of currents, reduction of stray losses, etc.) which must be met by engineering skill and highly perfected workmanship.

You will appreciate the many fundamental improvements in Pennsylvania Furnace Transformers, which **assure greater reliability, lower operating costs and longer life!**



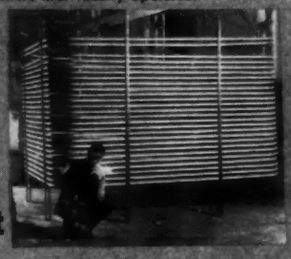
Ability to Withstand Short Circuits

Having low inherent impedance, furnace transformers are subject to heavy short circuits. This condition is complicated by the wide range of voltages, which necessitates cutting out large portions of the primary windings. Through the use of CIRCULAR COILS and ingenious winding arrangement, short circuit stresses are practically eliminated.



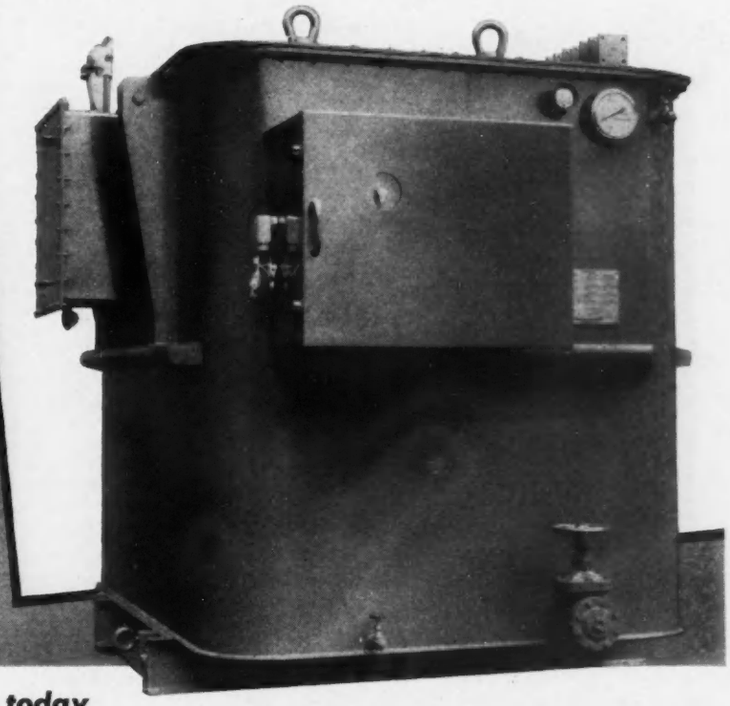
Straight-Line Tap Changers

Surface is cleaned before contact is made, insuring lower contact resistance and absence of heating. No springs or other parts to get out of order. Under short circuit the contacts grip more tightly and without tendency to loosen. In three-phase transformers all tap changers are operated by a common shaft, eliminating danger of setting in different positions as in cases where individually operated.



Ideal Cooling Arrangement

All turns of the water-cooling coil are arranged helically in a single layer and surround transformer core and coils. Hot oil moves downward along cooling coils, cool oil moves upward through vertical ducts in transformer coils. This results in an efficient, cool transformer capable of carrying heavy overloads with safety.



3-phase transformer for operating a 30 ton electric arc furnace

Write for Your Copy today

Write for your copy of our new 32-page brochure, entitled "In the Front Line of the Nation's Defense." Operating Engineers will find the installations shown in this book of exceptional interest.

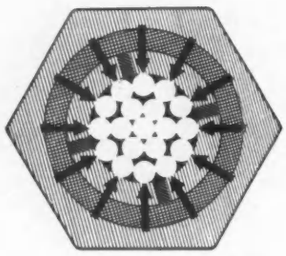
Pennsylvania TRANSFORMER COMPANY

808 RIDGE AVENUE, N. S., PITTSBURGH, PA.

You can't make a good water connection by pressing at two points.

But give it a good "Gorilla Grip" all around and you will have a tight positive connection.

The same applies to mechanical electrical connectors.



Cross Section of "Gorilla Grip" Connector

National Electric "Gorilla Grips" have 100% all around contact - not just two spots.

Pressure is uniformly distributed over full contact area of the Conductor and there is a "Gorilla Grip" for every Conductor, no matter where it terminates. "Gorilla Grips" can be used over and over again Emergency stock sets available or assembled to meet your needs with required fittings.

Write for descriptive booklet.

National Electric
PRODUCTS CORPORATION
900 Fulton Building Pittsburgh, Pa.

ment. New mill will cost close to $2,000,000. Work is scheduled to begin at once.

BUFFALO, N. Y.—Board of Education, City Hall, Buffalo, James Storer, secretary, receives bids until October 14 for diesel engines and equipment, as per plans on file at the office of Bureau of School Architecture, address noted.

KEOKUK, IOWA — Mississippi River Power Co., Keokuk, plans extensions in 69,000-volt transmission lines in parts of Adams and Hancock Counties, Western Illinois, including power substation facilities. Cost estimated over $250,000.

DALLAS, TEX.—Dallas Power & Light Co. has secured federal approval for priority for materials for proposed expansion in Mountain Creek steam-electric generating station, and will proceed with work soon. Installation will include a new 25,000-kw. turbine-generator unit and auxiliary equipment. Extensions will be made in switchyard and transmission lines. Completion is scheduled in about 24 months. Entire project will cost about $2,200,000.

LOS ANGELES, CAL.—Los Angeles Water and Power Bureau recently has rejected all bids received for construction of a seven-duct conduit underground transmission line from new Harbor steam-electric generating station at Wilmington, now in course of erection, to receiving power substation "C," and proposes new call for bids soon. Lowest quotation received was $147,000 (Specifications 3835).

LOUISVILLE, KY.—Hycar Chemical Co., Akron, Ohio, a joint subsidiary of B. F. Goodrich Co., Akron, and Phillips Petroleum Co., Bartlesville, Okla., plans installation of motors and controls, switchgear, duct lines, industrial lighting system, regulators, conveyors and other equipment in new plant near Louisville for production of synthetic rubber. Output of plant will be used by government, which will provide financing for project through Defense Plant Corporation, Washington, D. C., in amount of about $2,750,000. New plant will be located on Ohio River waterfront, with power supply to be furnished by Louisville Gas & Electric Co., Louisville, which is now building a new generating station in same vicinity. A power substation will be located at plant site for this purpose.

FERGUS FALLS, MINN.—Otter Tail Power Co., Fergus Falls, plans extensions in transmission lines for connection with high-tension systems of Minnesota Utilities Co. in Twin Valley and Wheaton, Minn., districts, now being purchased. Also will carry out expansion in power substations and switching facilities in same areas. Properties noted will be consolidated with Otter Tail company system.

GRAND COULEE, WASH.—Bureau of Reclamation, Denver, Colo., receives bids until October 20 for four 230-kv., 1,200-amp., eight-cycle oil circuit breakers; two 230-kv., 1,200-amp., three-cycle oil circuit breakers; six 115-kv., 1,200-amp., eight-cycle oil circuit breakers; four 230-kv., 1,200-amp., three-pole manually gang-operated selector-type disconnecting switches, with manually gang-operated grounding blades; 13 230-kv., 1,200-amp., three-pole, single-throw, similarly-operated disconnecting switches and grounding blades; eight 115-kv., 1,200-amp., three-pole, single-throw, similarly operated disconnecting switches; and two 230,000-volt, three-phase lightning arresters for suspension mounting, all for Grand Coulee hydro-electric power plant, Columbia Basin project. All equipment to be installed by government (Specifications 994).

HELP WANTED?

Are you desperately looking for a substitute for that material you have always used and which now you can't get due to defense conditions?

We Ask You—

TRY STAR PORCELAIN

It has a surprisingly wide range of characteristics, and DIES ARE LESS EXPENSIVE.

Write for bulletin giving technical information on all kinds of STAR PORCELAIN.

The STAR PORCELAIN COMPANY
51 Muirhead Ave. Trenton, N. J.

Insulation Tests Simplified!

In Stock for prompt shipment

NEW STANDCO B-5 MEGOHMER

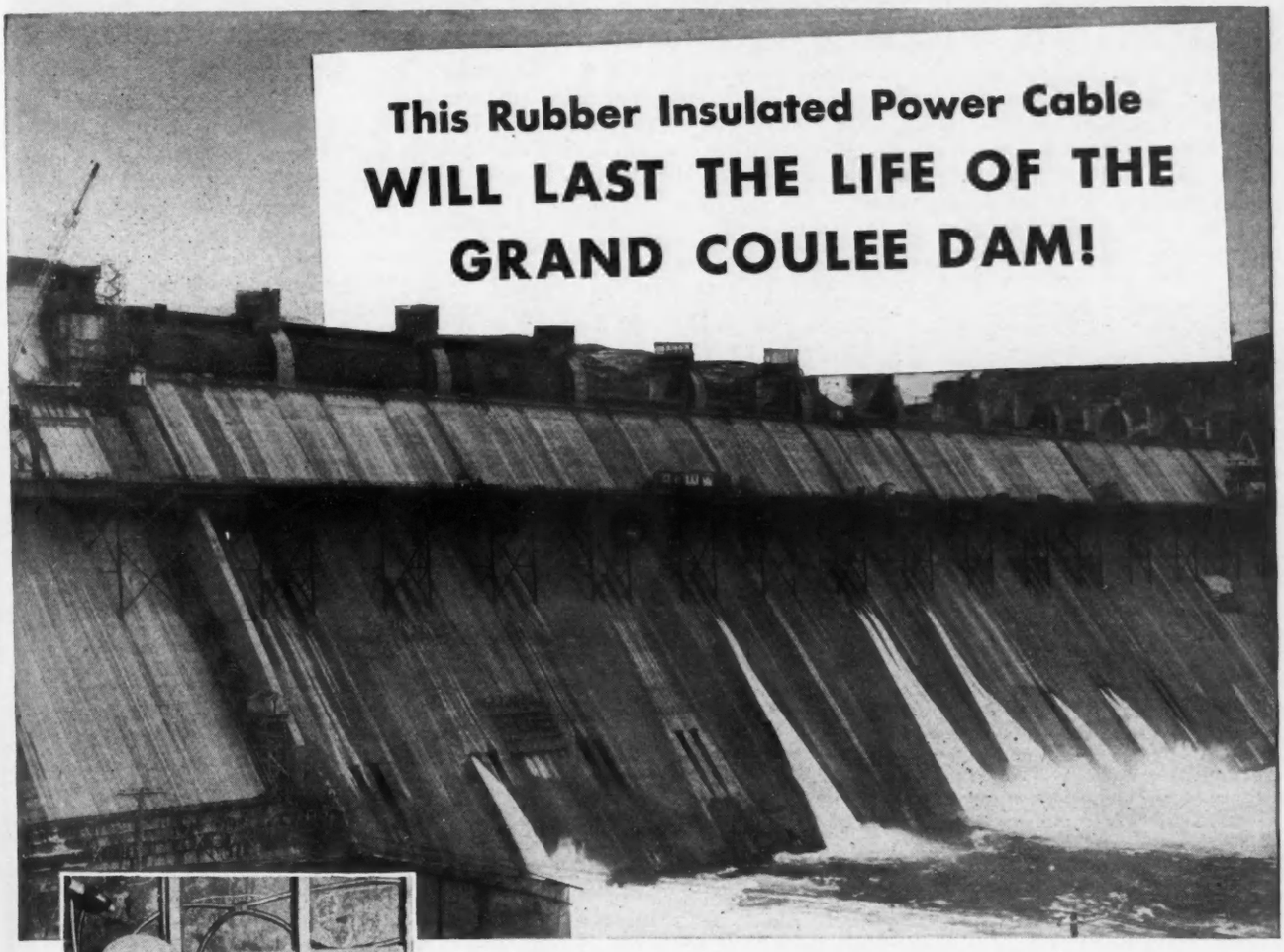
Ranges: 0-200 Megohms
0-2000 Ohms
0-300 & 0-600 Volts DC

No more tiresome cranking of a hand driven generator.

Steady test voltage of 500 volts DC instantly available, at the touch of a push button. Direct readings of insulation resistance obtained on special color-graded scale without any calculations.

● ***Write for New* BULLETIN 430**
for details of design and operation of this radically new instrument.

HERMAN H. STICHT CO., INC.
27 Park Avenue • New York, N.Y.



TYING *Amarine Rubber Insulated Cables in position prior to pouring of concrete.*

A.S.&W. AMARINE 40 *is buried for life in the cement gates of Grand Coulee Dam... an important part of the induction heating system that will prevent the freezing of these gates.*

WHEN a permanent heating system to de-ice the eleven huge gates of Grand Coulee Dam was considered necessary—A.S.&W. Amarine 40 was furnished as the conductor. This cable will be buried for life in the concrete of the gates.

Back in 1909, American Steel & Wire Company made the first non-leaded submarine cable, insulated with a special water-resistant rubber compound now called Amarine.

One of these cables, after 27 years of continuous operation immersed in water, was recently brought up for inspection — and found to be in excellent condition, still good for many more years of service.

This is only one of the instances that prove the outstanding lasting qualities of Amarine. No other non-leaded submarine power cable can even approach this record. It takes years to measure the life expectancy of an electrical power cable. No laboratory test has yet been devised that exactly reproduces the conditions of actual service.

That's why American Steel & Wire Company bases all cable recommendations on actual performance, and never on empirical short-term tests. That's why Amarine was accepted by Grand Coulee Dam Engineers.

AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

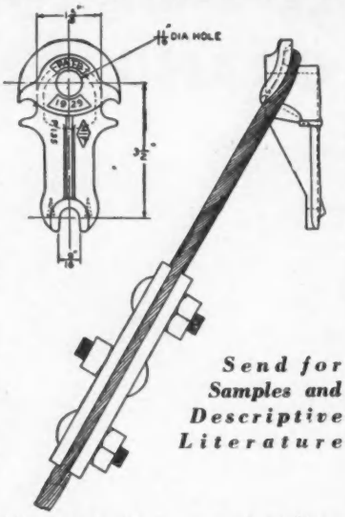
Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Export Company, New York

UNITED STATES STEEL

Simplified Guying Specifications

A new circular available on request features suggestions for Simplified Guying Specifications based on three simple galvanized malleable castings — M.I.F. P135 Through-bolt Guy Hook as illustrated, P128 Thimbleless Eye Nut, and P143 Curved Ribbed Washer — which users definitely rate equivalent to standard ⅝" bolts and guy strands with which they are used. A logical starting-point for Through-bolt Guying is provided when a ⅝" through-bolt constitutes the means for applying corner or dead-ending stresses against which pole must be guyed — then, using suitable attachment on other end of same bolt.



Send for Samples and Descriptive Literature

Test competitively with present guying specifications by sending assorted trial order at following 100-lot F.O.B. Branford prices:

P135 Guy Hook . . . $18.20/C
P128 Eye Nut 14.70/C
P143 Curved Washer 7.70/C
P126B Bolt Eye . . . $24.50/C
PA128-6 Anchor Rod 66.70/C
(⅝" x 6 ft. Thimbleless)

Or, we will send sample P135, P128, and P143 without charge or obligation in response to request on Operating Company letterhead.

Use the Guy Hook for anchor guys, and the Eye Nut or Bolt Eye for pole to pole and other relatively flat guys, and the Curved Washer to minimize slotting or splitting stresses in the pole. Larger sizes available for heavier service. More than 1,000,000 successful M.I.F. Guy Hook installations prove these specifications are practical.

Misc. M.I.F. Pole Hardware Specialties: — *Williams Pole Mounts — Pole Stubbing Clamps — Aerial Cable Messenger Clamps and Insulated Hangers — Malleable Secondary Racks and Clevises — Tubular Pole Fittings — Transformer Hanger Plates for Through-bolt Mounting — Malleable Crossarm Gains — Screw Anchors — Sidewalk Guy Fixtures and Alley Arm Braces — Guy Strand Dispensing Holders — Through-bolts and Double-arming Bolts, etc.*

MALLEABLE IRON FITTINGS COMPANY
Pole Hardware Dept. [Factory and New England Sales Office] Branford, Connecticut
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LINE & CABLE ACCESSORIES, Ltd., Toronto

NEW BOOK

Electric Distribution Fundamentals

10 DAYS' FREE TRIAL

SHOWS HOW TO SOLVE

the problems of design, construction, operation, service, methods, equipment, mechanics, and materials of electric distribution

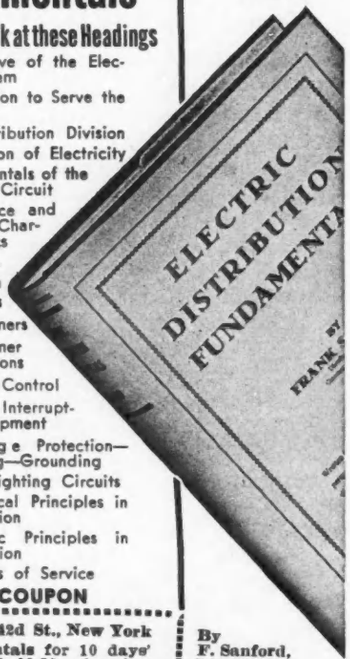
From a non-engineering viewpoint, this book outlines features of both utility distribution and the industrial and inside wiring branches of service to the outlet.

THE ABC OF ELECTRIC DISTRIBUTION

Tells how the distribution system is designed and built, how it works, and how it is serviced and operated; explains equipment and its use, design of carrying lines, problems of maintaining flow, and materials; discusses how distribution fits in economically with the general system of electric supply; covers voltage drop, wire size calculation, power factor, etc., etc. Practical design problems are included with solutions based on diagrams instead of difficult mathematics.

Look at these Headings

- Perspective of the Electric System
- Distribution to Serve the Load
- The Distribution Division
- Generation of Electricity
- Fundamentals of the Electric Circuit
- Inductance and Related Characteristics
- Tools for Electrical Problems
- Transformers
- Transformer Connections
- Voltage Control
- Current Interrupting Equipment
- Voltage Protection—Lightning—Grounding
- Street Lighting Circuits
- Mechanical Principles in Distribution
- Economic Principles in Distribution
- Measures of Service



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REA Allots Funds; Contracts Approved

Rural Electrification Administrator Harry Slattery recently approved allotments totaling $1,462,000 to construct two new rural power systems in the Wisconsin dairy region, to permit a Georgia cooperative to expand its system to meet demands for power from various defense establishments which have just been constructed, and to construct a transmission network to carry cheap power from the Santee-Cooper development to South Carolina rural electric distribution cooperatives.

Details of the allotments are as follows:

The Colquitt County Rural Electric Co., Moultrie, Ga., J. H. Halpert, supt., $75,000 to construct 12 miles of line to serve two Army air bases; $245,000 to add 328 miles of line and 800 new members to its present distribution system.

The South Carolina allotment of $750,000 was made to a new transmission cooperative now being organized, with headquarters in Charleston County. This cooperative is made up at present of about sixteen local REA-financed power distribution cooperatives. The transmission lines will carry power from Santee-Cooper and possibly other public power developments in South Carolina to the member distribution cooperatives.

The two new Wisconsin systems will be built by the Marathon-Portage Electric Cooperative, Inc., of Wausau, which has a loan of $192,000 to build 210 miles of line in Marathon and Portage counties to serve 494 members, and the Bayfield Electric Cooperative, Inc., of Iron River, to which REA allotted $202,000 to build 246 miles of line in Mayfield, Ashland and Douglas counties to serve 619 members.

REA loans since it was created in 1935 now total $390,289,121.

Among the construction contracts which have recently been approved are the following:

WISCONSIN—Waushara County Electric Cooperative, Inc., Wautoma, Edward E. Stickney, supt., and Wisconsin Development Authority, Madison, Wis., engineer, contract to G. A. Ferguson, Crandon, Wis., 307.75 miles of line, 484 members; bid, $186,157.

WASHINGTON—Columbia County Rural Electric Assn., Inc., Dayton, Oakley A. Kendall, supt., and Preston L. Adkins, The Dalles, Ore., engineer, contract to Union Electric Co., Manette, Wash., 77 miles of line, 77 members; bid, $56,703.

WEST VIRGINIA—Harrison Rural Electrification Assn., Inc., Clarksburg, Roy E. Cork, supt., and Gibbs & Hill, Inc., Harrisburg, Pa., engineer, contract to O'Rourke Electric Service, Mt. Vernon, O., 95 miles of line, 290 members; bid, $73,675.

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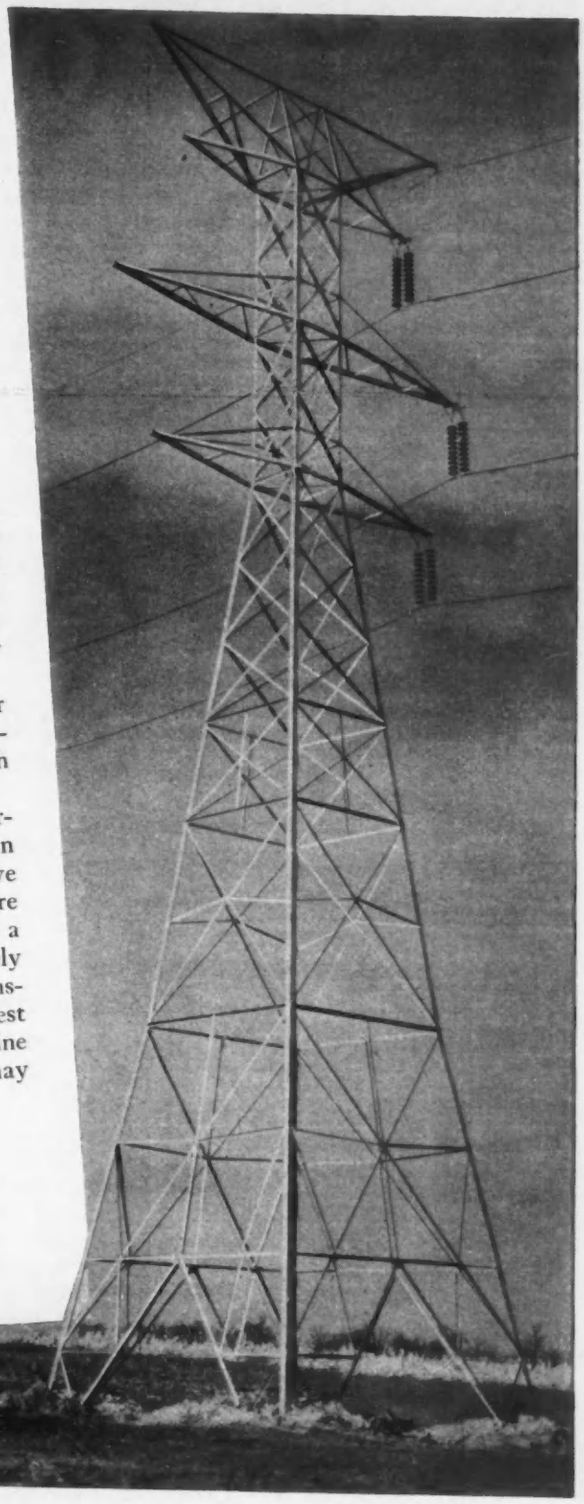

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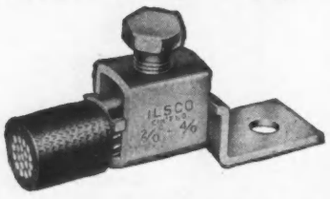

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[*Continued from page* 63]

ance. It is expected that the ground resistance of the rods on this line will be considerably lower than the values mentioned.

Conductors are No. 2 A.C.S.R., eight strands, equipped with armor rods at all suspension points. Aluminum dead-end clamps were used. The conductors were strung to a maximum tension of 50 percent of the ultimate strength under the heavy loading conditions stated in the National Electrical Safety Code. Shield wire is $\frac{5}{16}$-in., utilities grade, galvanized steel strand strung to the same sag as the conductors. This wire is supported by a clamp-top, shield-wire bracket attached at the top of the pole. Span lengths vary to conform to the contour of the ground, but are for the most part approximately 300 ft.

Performance of this line has been satisfactory for the nine months it has been in operation. It is believed that this design represents an improvement over previous types of single-pole lines used by the company.

•

Arkansas Power Applies to Serve Acid Plant

Arkansas Power & Light Co. has filed an application with the state Utility Commission to serve the $8,000,000 picric acid plant at Marche. The company's application seeks to string a line to serve eleven rural customers, adding that the "applicant also proposes to serve the national defense industry to be located in the vicinity of Marche" with "additional lines and facilities to be constructed from time to time."

The First Electric Co-operative Corp. of Jacksonville recently withdrew its application to serve the Marche area on the grounds that Arkansas Power & Light already had lined up the rural customers.

•

Gives Preview of Plant

Louisville Gas & Electric Co. offered the public recently a preview of its new 50,000-kw. steam power station on Bell's Lane, with a scale model of the plant set up in the ground-floor lobby of the company's Chestnut Street offices. The plant, scheduled to go into operation in the summer of 1942, is approximately 25 per cent completed.

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are made of high grade cotton fabric treated with special varnishes from Acme's own varnish plant. They have great tensile strength and flexibility and may be stretched snugly into all corners and crevices, making a mechanically smooth and electrically efficient seal. Offered in bias or straight tapes or rolls up to 36" wide, yellow or black. Samples if requested. Address *The Acme Wire Co., New Haven, Conn.*

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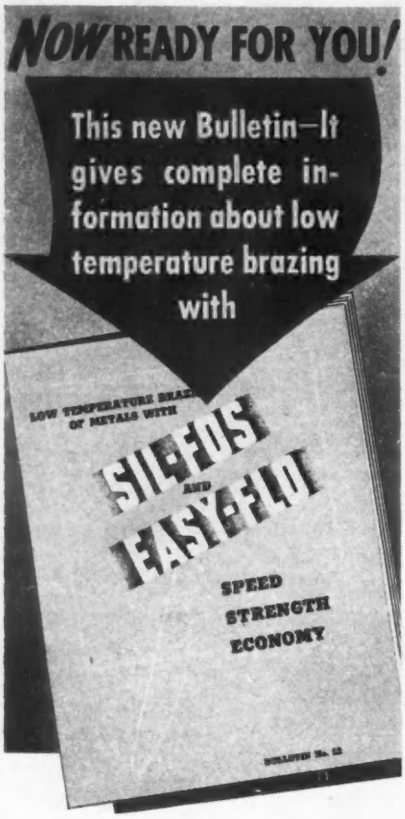

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LETTERS TO THE EDITOR

Requirements Modified in New N.E.S. Code

To the Editor of ELECTRICAL WORLD:

With reference to the article "Requirements Modified in the New N.E.S. Code," by C. S. Cummings of Western Union Telegraph Company and me, appearing in your September 6 issue, the captions for the illustrations were reversed. While this is obvious in studying the two figures and the text which applies to them, we believe it would be desirable to make this correction. The caption for Fig. 1 should read "Loading district boundaries are revised;" for Fig. 2, "Adjustments made in clearance increase increments for long spans to avoid penalizing new types of small conductors."

In addition, we should like to correct a slight error that was inadvertently made in the loading map. Due to the fact that maps of different sizes were made in transferring these lines from one map to another. The correction is:

In that part of the new boundary line between the medium and light districts of the loading map, which extends east and west across Texas, there should have been no dash line shown above the solid line, as in this section the boundary lines between the medium and light districts, in both the fourth and fifth editions of the Code, coincide on the 31st parallel of latitude.

A. B. CAMPBELL,
Engineer,
Edison Electric Institute

•

Accrued and Actual Depreciation

To the Editor of ELECTRICAL WORLD:

I have read with much interest the editorial entitled, "Implication of Prudent Investment Depreciation Theory," appearing in the ELECTRICAL WORLD of September 6. The editorial presents a practical difficulty in administering what some people consider to be the theoretically correct treatment to be accorded depreciation reserve. I refer to the wide fluctuations in rate base which result from deduction of the depreciation reserve which itself is subject to wide fluctuations in the event of sudden and large retirements of property.

I would like to call your attention to what I believe is the misuse of the word

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"accrued" in the following sentence at the end of the first paragraph:

"But if we assume, as we must, that *accrued* and *actual depreciation* are approximately the same, it is hard to see how the customer has contributed to anything but the replacement of the property he has been using."

It seems to me that the writer of the editorial has fallen into the rather natural error of assuming "accrued depreciation" refers to the reserve that is accrued on the books. I believe that the term is usually considered to apply to what the editorial writer calls "actual depreciation," although, in my judgment, actual depreciation is usually considered to refer to the depreciation attributable to physical deterioration and does not include the portion of depreciation which is attributable to the perceivable approach of retirement because of some special local reason. If my views are correct, and I believe they are shared by almost every student of the subject, the sentence in the editorial should have read:

"But if we assume, as we must, that the reserve for depreciation is approximately equal to the accrued depreciation, it is hard to see * * *."

H. J. FLAGG,
State of New Jersey Board of Public Utility Commissioners
Newark, N. J.

(We wish to thank Mr. Flagg, who is a member of NARUC Committee on Depreciation, for suggesting this technical correction but more particularly for giving emphasis to the instability of rate base which logically follows in the wake of application of the prudent investment theory.—EDITORS)

•

Municipal Plants

TELL CITY, IND.—Trustees of the Associated Gas & Electric Corp. have announced that they will accept the city's offer of $475,000 for the plant of the Ohio River Power Co. Included in the price is the distribution system in Tell City and the high voltage lines to Cannelton, Ind. Some time ago the company turned down a similar offer. A city election will be called in both cities as the first step in purchasing the plant.

SLATER, IOWA—Citizens in a special election recently held voted to issue bonds for construction and establishment of a $65,000 municipal light system. Iowa Electric Light & Power Co., serving the city at present, was refused a franchise renewal in an election held three years ago and has been operating since that time without a franchise.

DYERSVILLE, IOWA—At a special election held on September 22 the citizens voted to grant a fifteen-year renewal of the franchise held by the Eastern Iowa Electric Co., instead of building a municipal plant. Vote was 575 for franchise and 438 opposed.

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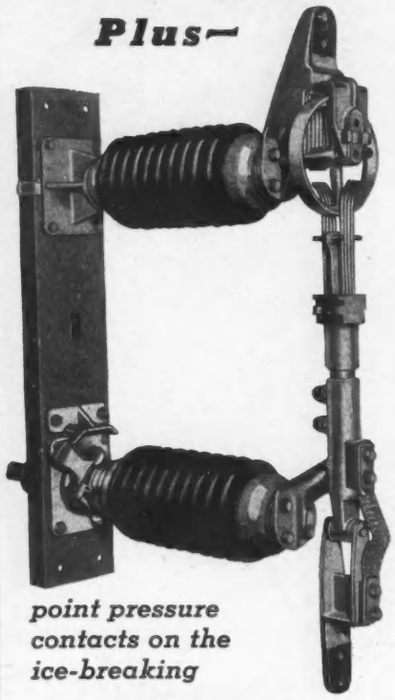

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[*Continued from page* 54]

to increase faster than new power station plant can be installed and, in addition, we find that plant outages for maintenance are longer than usual owing to delay in obtaining spare parts from the manufacturers, who are so busy with other work.

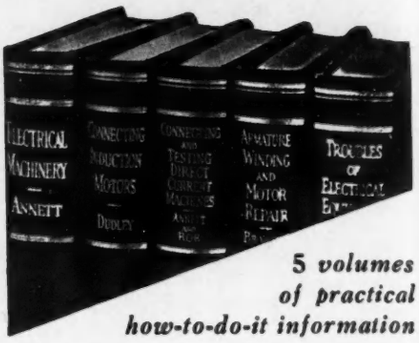
As regards rates and earnings, the principal affecting factors have been the shifting of population from London and other large towns due to the government evacuation schemes, the voluntary movement of people who can afford it from the more vulnerable areas, and the general policy of dispersal of industry to factories located in rural areas. Broadly speaking, it is only in London that serious falls in earnings have occurred. Residential and commercial revenue is down considerably in the West End, but in many other parts of London the growth of the industrial load has more or less balanced the loss of domestic and commercial revenue. Apart from decreased earnings, working costs have been increased in the south of England, due to substantially increased coal prices, caused mainly by higher transport costs. Rates have, therefore, had to be increased once or twice since the war began, the present figures being from 20 to 40 percent higher than pre-war.

Domestic Load Increased

In industrial areas in other parts of the country, where there is a very large increase in the power load, the tendency for people to use more electric heating in their homes, when household coal deliveries are below normal due to transport difficulties, has resulted in increased gross earnings, and many utilities situated near coal fields have been able to avoid any increase in rates. The latter remark also applies to utilities serving rural areas where the population has greatly increased and large power loads have been connected.

I think you will appreciate that the general domestic use of electricity has tended to increase with the greater amount of industrial employment, longer working hours and greater spending power which has little outlet, apart from savings, because the supply of goods in the shops has been severely limited by government action, with a view to concentration of

Every phase of electrical maintenance and repair work covered in this Library



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2042 pages, 1721 illustrations and diagrams

These books show you how to

—install all types of motor and generator units;
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Now, in addition to four well known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a new book full of helpful maintenance information, special trouble-shooting charts, explanation of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

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manufacturing capacity on munitions and to avoid inflation.

As regards bomb damage, I think you know that we had a national scheme of spare transformers and switchgear for main transmission lines and substations, but these are small targets and difficult to hit. Probably the greatest value of an extensive transmission system is the ease with which large power loads may be supplied in any part of the country and this advantage has been strained to the utmost. With regard to protection of plant from bomb splinters, steel plate has not been found to be so good as brick or concrete, and 14-in. brick walls are now a general practice, particularly around oil-filled gear.

On the distribution side the general use of high-tension ring mains and fairly well interconnected low-tension distributors enables the supply to be maintained to all habitable premises. Underground cables stretch and keep on working to a surprising extent, but if cables are cut repairs are quickly made, provided the bomb crater is not full of water or gas from the breakage of pipes.

The last few months have not given rise to any fresh questions; power loads are still increasing; a considerable amount of electric cooking equipment has been installed for communal feeding in factory canteens, civic restaurants and school feeding centers; a certain amount of simple domestic heating and cooking equipment has also been supplied for use in areas which have been badly damaged, or in temporary rehousing. The versatility of cheap electric cookers of 750 to 1,500 watts for boiling water, cooking food and space heating has been a great boon to many families.

•

Grand Coulee Unit Will Need 780,000 hp. Motors

During the present fiscal federal year the Bureau of Reclamation, Denver, Colo., plans construction of a large pumping station at Grand Coulee, Columbia Basin project, Wash., designed to lift all irrigation water from the storage reservoir into the Grand Coulee distribution reservoir. The pumping plant will have an ultimate installation of twelve electric pumping units, each driven with a 65,000-hp. motor, to develop a normal lift of 280 ft. and a maximum lift of 367 ft.

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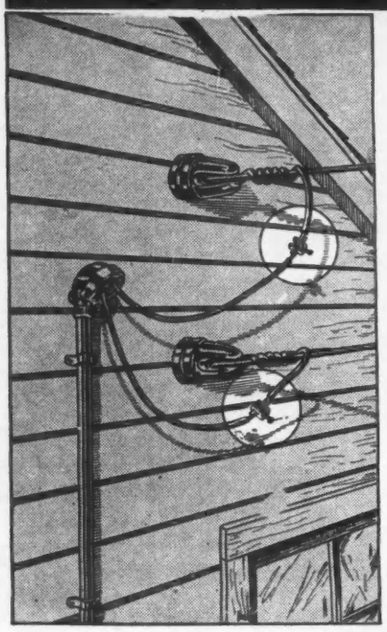

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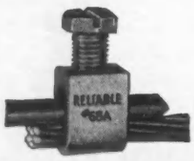

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ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES
3145 CARROLL AVENUE • CHICAGO ILLINOIS

Standardizing Substation Designs

[*Continued from page* 61]

These ideas in relation to the use of uniform structures may also be extended to higher voltage substations. Representative designs provide for 11-kv. and 33-kv. layouts. Where the initial installation does not include oil circuit breakers they may be readily added at any time.

Experience with standardization of substations along the above lines has proved very satisfactory with us. In the first place there is a considerable saving of time required for designing and the preparation of drawings. When assembly drawings of the frequently used layouts have been prepared it is possible to get out prints for duplicate new jobs with no design or drafting whatever. The same savings in a measure apply to the steel detailing and fabricating. In addition, the construction forces become familiar with the set-up and thus work to better advantage where the several substations are essentially alike. Since the concrete footing details are also standardized it has been found possible to make worth-while savings by constructing the forms for these piers in such a way that they may be knocked down and used again on following jobs. The use of metal forms would appear to have advantages for this class of service.

Finally, when standard structure, foundation and assembly drawings are available it is possible to order the structure, deliver foundation prints to the field and get construction work under way much earlier than would otherwise be the case. This is of particular advantage in meeting the requirements of important rush jobs which inevitably crop up. As an example of what can be done in emergency using standard details, the steel structure shown (Fig. 5) for a 33-kv. to 2,300-volt substation with feeder oil circuit breaker and regulators was ordered by telegraph to be fabricated from warehouse stock and was shipped in two weeks. Foundation drawings were mailed to the field the day the steel was ordered, so that foundation piers were ready for the steel when it arrived. The ability to get the field work started promptly also allows the construction forces the greatest possible advantage when unfavorable weather conditions have to be overcome.

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FOR
Electrical Specialties
High and Low Voltages

IMPERIAL
PORCELAIN WORKS
TRENTON, NEW JERSEY

Condenser Kvar Source Surpasses Idle Hydro

[*Continued from page 69*]

cation when any of these temperatures exceed a predetermined safe value.

An addition to the present substation building houses the housing of this condenser, with overhead crane facilities for removal of the rotor should repairs be necessary. By means of air ducts and dampers controllable by the substation operator, the warm discharge air may be vented outdoors through the roof or utilized to heat the main substation building. A rotating self-cleaning air filter is provided below the unit in the incoming air supply to reduce the deposit of dust and particles on the windings. Approximately 30,000 c.f.m. of air per minute passes through the filters, condenser and ducts. The latter are equipped with a canvas boot to prevent transmission of machine vibration to the upper duct system and to facilitate removal of the upper duct for full travel of the overhead crane. The fresh make-up air is supplied through an opening in the wall of the basement of the condenser room, with provision against drawing in leaves and foreign matter.

Substation Heating

In cold weather, when it is desired to circulate the warm discharge air through the substation control room, the dampers in the discharge flue are turned to direct this air into the condenser room. It then passes through a grill and register into the control room, down the open stairwell into the basement, and through a doorway to the condenser room basement, where it re-enters the condenser through the air filters. Should this path of circulation be impeded, gratings in the condenser room floor provide an alternate path for the air travel. A fire manifold was built into the stator of the machine and pipe connections made from it to the basement of the main substation room. This was not permanently connected to the building water supply system, the object being to prevent any leakage through shut-off valves from entering the condenser. A short hose connection from the building water supply is adjacent to this pipe connection to the fire manifold, and the substation operator can quickly couple these for extinguishing any fires in the machine.

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See Cat. 1 Sec. 3B for full details.

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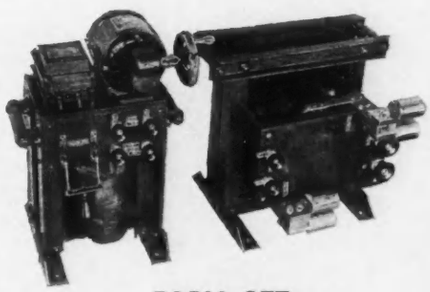

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"Safety with Light" Campaigns Augment Revenues

[*Continued from page* 56]

asm of an already ambitious organization to even greater accomplishments. The Alabama Jay-cees, under the leadership of the "Safety With Light" committee, set to work with renewed efforts.

Bessemer Installation

The highway that carried the largest amount of traffic in the state was the Birmingham-Bessemer Boulevard. Under the direction of the Bessemer Junior Chamber of Commerce this important connecting thoroughfare was proposed, considered and adopted as one of the first "Safety With Light" projects under the new federal defense program.

This 5-mile project was dedicated December 21, 1940, with U. S. Senator Lister Hill and many other dignitaries attending. This particular road is served by the Birmingham Electric Company under a similar arrangement with the State Highway Department.

The "Safety With Light" program is contagious. Since the dedication of the two foregoing installations numerous requests for additional projects have been received. One 2-mile installation has been authorized and several other projects have received favorable consideration.

With such magnificent public acceptance, due solely to the "Safety With Light" program, it can be anticipated that it is only a matter of a short period of time before safety lighting will be universally adopted to eliminate the hazards of night driving, particularly on the more dangerous location of our more heavily traveled thoroughfares, thus enlarging even more the field of public service to which our companies are dedicated.

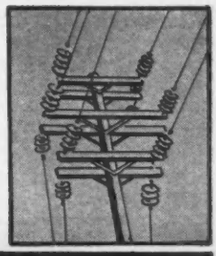
•

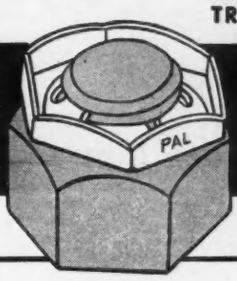
Gets FPC Extension

Federal Power Commission has extended until October 15 the time allowed Mississippi River Power Co. to show cause why the company should not be required to make adjusting entries to bring its accounts in conformity with the joint recommendation of the Federal Power Commission and the Illinois Commerce Commission. The extension was requested by the company.

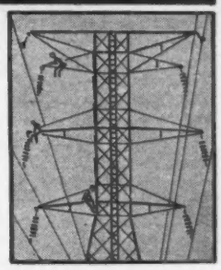
Keep Bolts Tight

ON WOOD POLE LINES and STEEL TRANSMISSION TOWERS with





Double Locking
PALNUT LOCKNUTS



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The PALNUT is a single thread locknut, made of tempered spring steel. When tightened, its arched, slotted jaws grip the bolt like a chuck, while spring tension is exerted upward on the bolt thread and downward on the regular nut, permanently locking both.

Once you apply PALNUT Locknuts, you can forget them! No need for constant checkups and retightening of bolts. PALNUT's double locking action prevents regular nut from loosening and bolt from backing out, despite vibration or shrinkage of parts. May be used on new or existing lines, without disturbing regular nuts. Only 2 full threads needed. PALNUTS are very low in price and easy to apply. May be removed and used repeatedly. Widely used by largest utility companies. Available at leading Pole Line Hardware Jobbers everywhere.

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Manufacturers of Locknuts and Self-Locking Nuts
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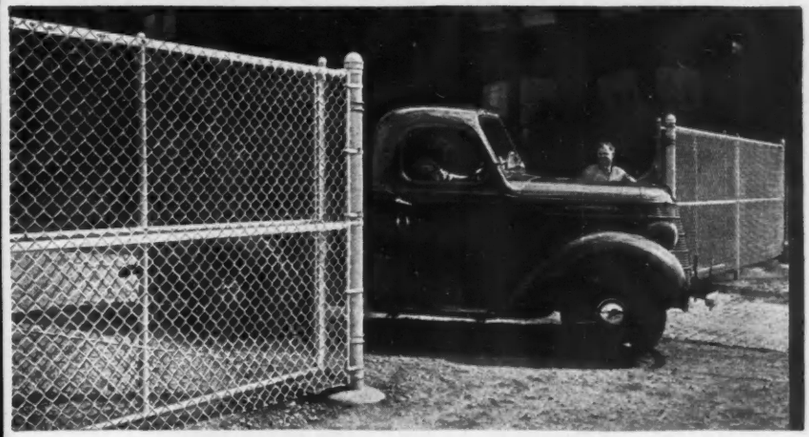

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Recent Rate Changes

CENTRAL NEW YORK POWER CORP. has announced that 16,000 commercial customers would receive a rate reduction amounting to $470,000.

COMMUNITY PUBLIC SERVICE CO. has reduced its electric rates $15,103 annually in six districts it serves in Kentucky, according to announcement by the Kentucky Public Service Commission. The cuts, effective with bills rendered on and after September 1, will be in Columbia, Mount Vernon, Owenton, Owingsville, Walton and Warsaw and areas near those cities. They apply to residential and commercial rates.

UTAH PUBLIC SERVICE COMMISSION has eliminated the "adjustment clauses" from the Utah Power & Light Co.'s new schedule on combination commercial and street lighting rates (ELECTRICAL WORLD, September 6, page 112). The new schedule contains rates reductions which will effect annual savings immediately of $100,000 a year and ultimately of $215,000 a year. The adjustment clauses would have permitted the power company to increase rates when the department of labor and commodity index rose above 95 and reduce them when it dropped below 65; to adjust rates to taxes and to the "power factor" in the case of commercial schedules. "We refused to permit the adjustment clauses to become operative," said Chairman George S. Ballif of the commission, "because we do not believe it is sound rate making to tie rates to commodity prices . . . It is our belief that there is no connection between commodity prices and net revenues of a power utility . . . For the same reason, Mr. Ballif said, the commission believed the power company should be able to take care of increased taxes, which is "one of the legitimate costs to be borne by an increase in revenue." The commission eliminated the power factor adjustment clause, because it did not have sufficient evidence to justify it and because the utility itself had not shown sufficient reason for permitting its adoption, according to the commission.

ILLINOIS COMMERCE COMMISSION has announced that rate changes in that state effective during the month of August, resulted in an estimated decrease of $116,812 in annual operating revenues. Reductions in electric rates amounted to $11,020.

HUSTISFORD, WIS., municipal electric utility has been authorized by the state Public Service Commission to adopt a new rate schedule which will save customers about $2,600 annually. The new rates for residential customers will include a monthly fixed charge of 60 cents plus from 6 cents to 3 cents per kilowatt-hour, depending upon the amount of electricity used.

OCONOMOWOC, WIS., municipal electric plant's new schedule of lower rates, effective November 1, has been approved by the state Public Service Commission. Residential customers will save about $3,500 annually and commercial customers about $4,500 a year, according to the commission.

•

Gets Switchgear Award

Los Angeles Water and Power Commission, Los Angeles, Calif., has awarded a contract to the Westinghouse Electric & Manufacturing Co. for 15-kv. metal-inclosed switchgear and spare parts, at $32,750 (Specifications 3822).

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(Classified Advertising)

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Specialized experienced in motor and control application, switch gear or layout of industrial buildings will be given considerable weight.

Give full details regarding experience, state age, education, citizenship, salary expected, present employer and give references in reply. Enclose small photograph. Will keep confidential.

P-962, Electrical World
330 W. 42nd St., New York City

ENGINEERING GRADUATES WANTED

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HYDRO-PLANT OPERATOR with 16 years experience in varied remote control operation desires position in Northwest. Married. Now employed. PW-965, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

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EXECUTIVE TYPE sales engineer B.S. E.E. plus additional training, sales management, sales correspondence and marketing. Previously lighting specialist with large midwest jobber, later midwest (8 states) district manager for large eastern manufacturer of lighting equipment. Age 32. Married, Gentile. Now located in Chicago. Future location optional. Willing to travel. Complete knowledge fluorescent and mazda commercial-industrial-residential lighting equipment. Present defense priority situation forces party to seek new permanent connection as sales executive or district representative. Excellent sales record. Now employed but available immediately. SA-963, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

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